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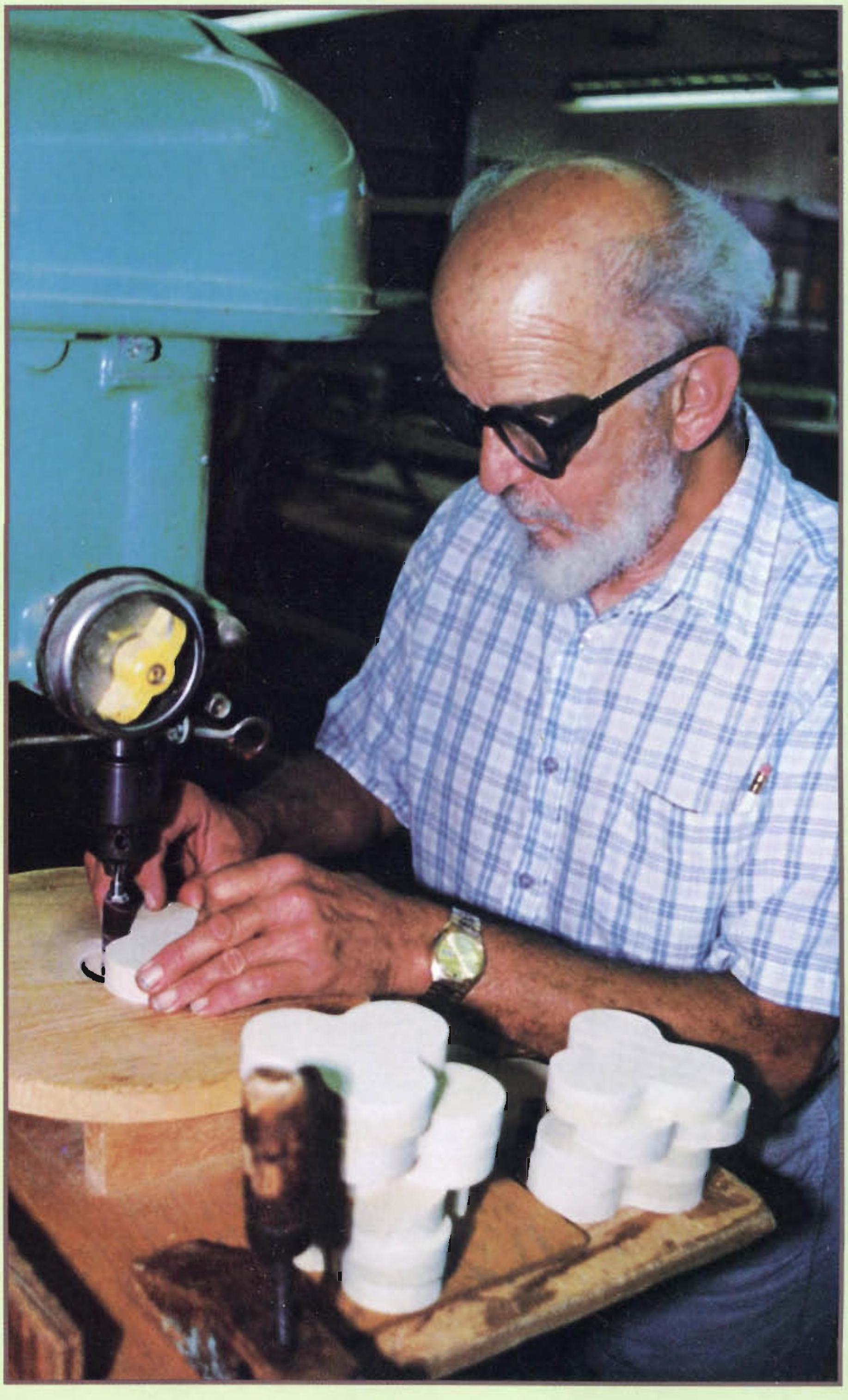

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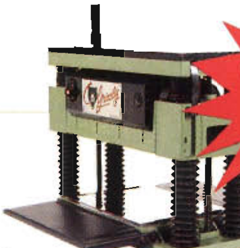

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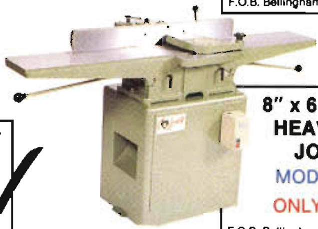

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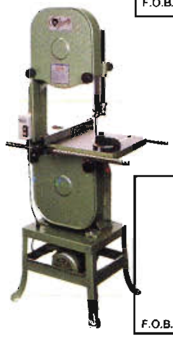

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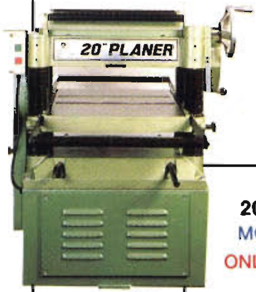

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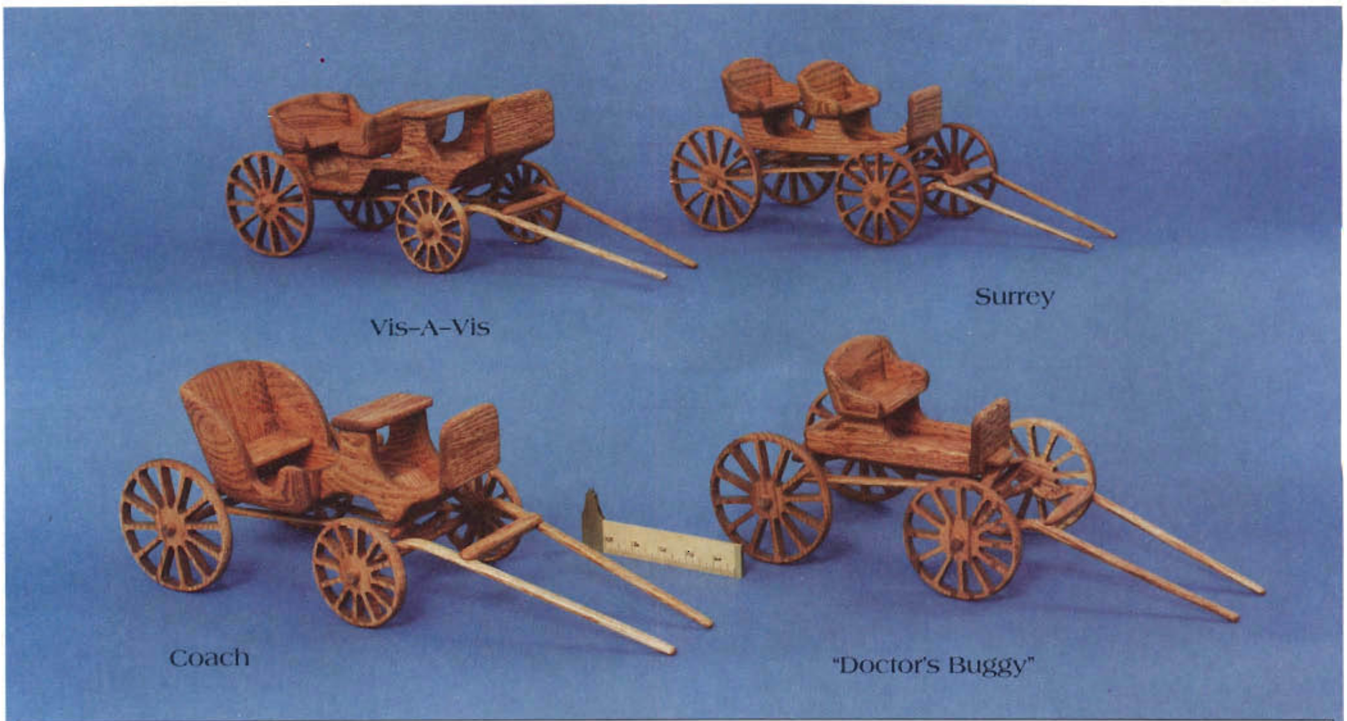

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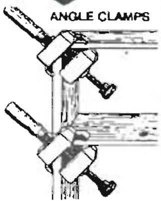

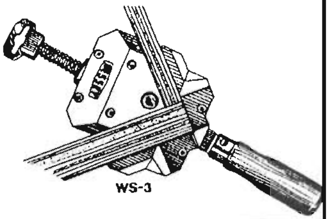

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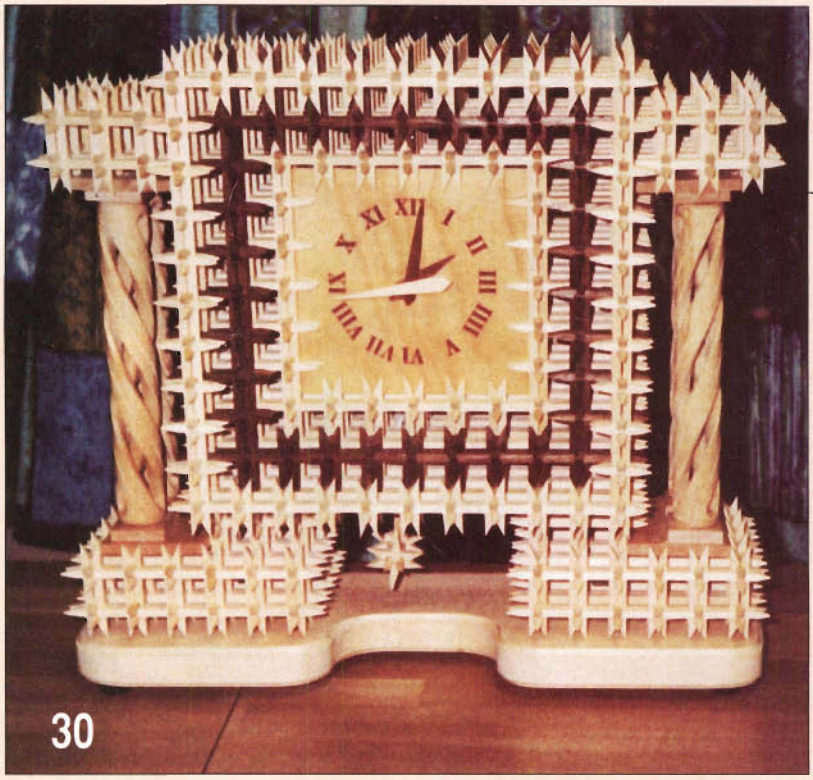

Beverly Newton

Warren Asa

On the Cover

Phil Fischer

Vallejo Senior High School Industrial Arts Instructor Chris Cristofolis drum sands the inside curves of one of our spiral lamp base segments. By stacking these segments on a lamp pipe and rotating each a few degrees off the previous segment, you can make a unique lamp. Leave the edges square or sculpt them smooth to create a twisted rope effect. The idea came from another shop teacher, Contributing Editor Don Kinnaman; his article starts on page 36.

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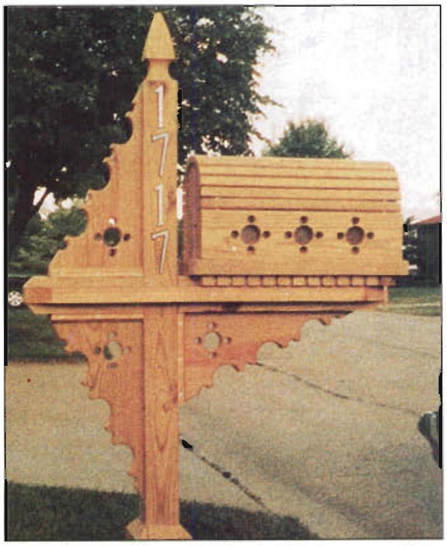
Letters

We welcome your comments, pro or con, about articles we publish. Send your letters to: Editor, *Popular Woodworking*, 1320 Galaxy Way, Concord, CA 94520. Letters may be edited for publication.

"Postal" Mailbox

I made your Victorian Mailbox Post in Issue #55, July 1990. The post design was great, however I didn't want to wait until your next issue came out, so I designed my own mailbox cover to be compatible with the post.



The construction is a little complicted, it is put together with spring–loaded stainless steel wire instead of cloth strapping seen on comercial mailbox covers.

Larry A. David, Rock Island, IL

Dangerous Ears

I made the Rocking Horse Chair and Tray from the PullOut™ Plans in the November 1990 issue. There is one thing I think should be changed in the plans: the wooden ears. A child could stumble and injure himself on the sharp point.

I made the ears from a piece of leather which looks as good and is a lot safer for the child.

Estel V. Dutcher, Barnett, MS

Overly Magnetic

In regards to the "Cube and Canister Drum Sanding System" (PW #56) and the angle drilling jig ("Here's an Angle," PW #57) I have made both. The plans were as perfect as imperfect man can make them, however I can't see how one could use 28 to 30 magnet segments to hold "The System" to the drill press table. I have eight segments in the bottom of mine, and it holds it to the table so tight that if I need to move it a bit to align the hole with the sanding drum, I have to give it a hard whack with the palm of my hand. If I had 28 to 30 segments, I'd need a crowbar to remove it from the table.

As for the jig for angle drilling, I made it according to the plans with the bolt through the hole in the drill press table. I anm thinking of removing the bolt and inserting magnetic segments in the bottom of the jig like I did for the drum sanding jig. It would save a lot of time by not having to hook up the bolt, washer and nut. I'm sure it would hold as tight; if not, I could always add a few more segments (but never 28 or 30).

Thomas W. Good, Good
Woodcrafters, Ephrata, PA

Sawdust Sinatra

I found Hugh Foster's piece "Woodworking Bricolage" in your *Out of the Woodwork* column (*PW* #58, January 1991) to be very comforting and reassuring. I started working with wood in 1936, and have always done it "bricoleur." There have always been the comments: "Why don't you use plans? Why don't you read the instructions? Why are you doing it this way?"

I think by the seat of my pants, and all of my projects have turned out well and have even been appreciated by some.

I love working with wood in my own way, and your article was so comforting because now I know someone else who likes to do it "my way."

Ruth McCool, Santa Ana, CA

Follow Up

Apparently, reader Maurice Bullard isn't the only woodworker who's unhappy with the blade–raising knob on his Makita 2711 table saw (see "Letters" in *PW* #57 and #58).

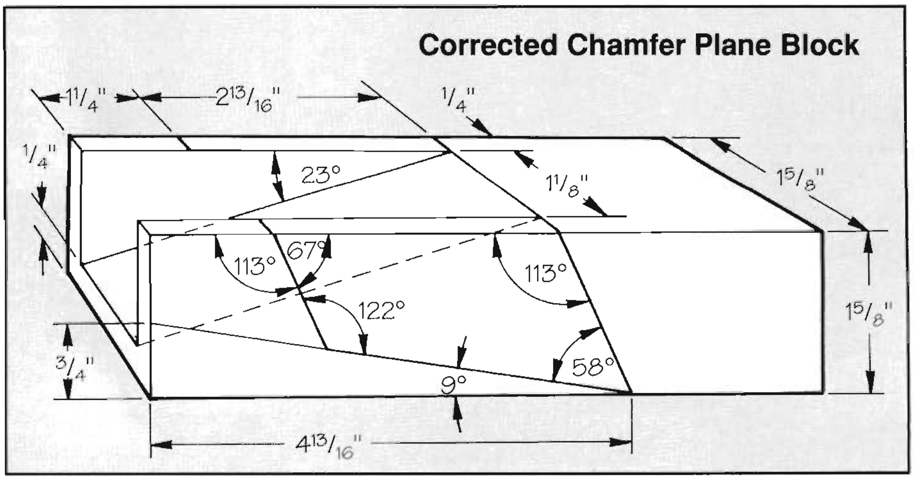
George H. Shelton of St. Catherines, Ontario solved the problem by replacing the knob with a handwheel from the tailstock of a lathe. He purchased the handwheel from Viel Tools Inc., 33 Rue Beloud, Isle Verte, Quebec, Canada G0L 1K0, phone 418-898-2601.

Arthur Lima of Stonington, Connecticut made his own wooden crank which fits over the knob on the Makita. He cut a disk from 2" material and inserted six $^{1}/_{2}$" dowels on the backside to correspond to the flutes in the side of the Makita knob. On the front he attached a large handle, substantially increasing the leverage.

Corrections

In the *Tricks of the Trade* column in our last issue, the tip "Repeat Cuts on the Band Saw" was inadvertantly attributed to the wrong person. Ken Hill, of Springfield, Missouri was the author of that tip.

In "Making a Chamfer Plane" (same issue) some of the angles in Figure 2 were incorrectly labled. The corrected illustration appears below. We regret the errors.



Corrected Chamfer Plane Block

Bob Chapla

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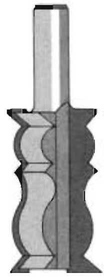

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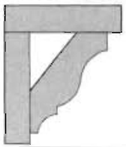

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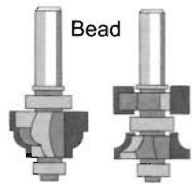

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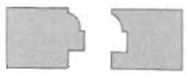

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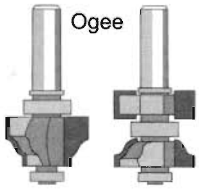

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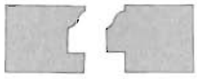

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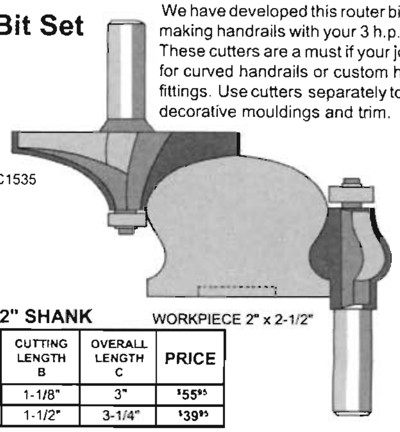
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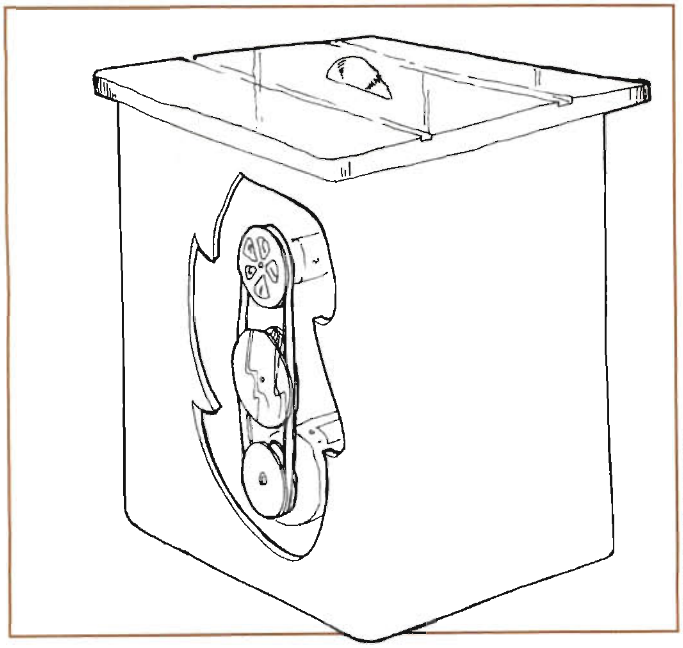
Tricks of the Trade

by Don Kinnaman

Tricks of the Trade shares readers' tips for making woodworking tasks easier and safer. If you've come up with a trick that would help other woodworkers, send it to Tricks of the Trade, c/o Popular Woodworking, 1320 Galaxy Way, Concord, CA 94520. Include any photos or sketches that help illustrate your idea (we'll redraw them). In this issue, we've devoted the entire column to tricks by Don Kinnaman. We pay $25 for each trick we publish.

Taking Up Slack

If you have a lot of slack in the drive belts between a motor and pulley so that the machine loses power, try this stopgap measure—you'll be surprised by how well it works. Measure the diameter of both the motor pulley and the machine pulley. Then lay out a wooden pulley of 3/4" stock with a diameter that is larger than both. If you use a flycutter on the drill press, you'll have an automatic dead center from the centering bit. Using this hole, fasten the disk to a lathe faceplate and use a parting tool to cut a V–groove in the edge of the disk. Stretch the drive belt and position the disk between the motor and the machine. Turn on the machine and your wooden centerless, axleless idler pulley will ride between the up and down movement of the belt, supplying good traction.



Illustrations by Graham Blackburn

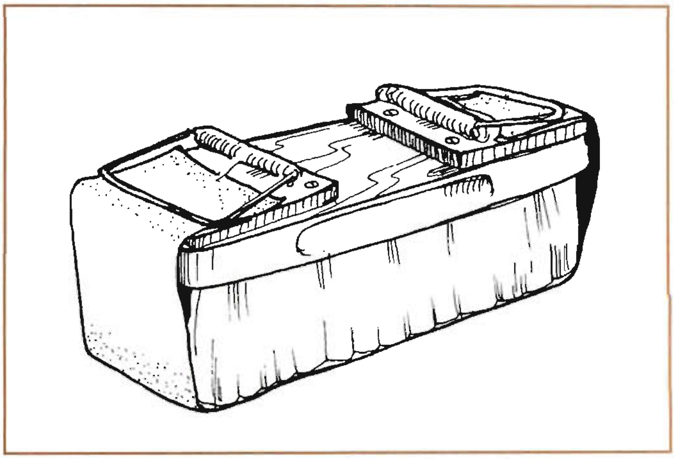
Band Saw Brushes

Band saw tires can pick up a lot of pitch and gum and other materials that cause mistracking or jerking cuts. I mounted a small bronze–wire–bristle brush (the kind made for cleaning suede shoes) to an L–bracket and bolted it to the frame of the saw to keep the wheels clean.

Don Kinnaman is a retired woodshop teacher from Phoenix, Arizona, and a frequent contributor to *Popular Woodworking.*

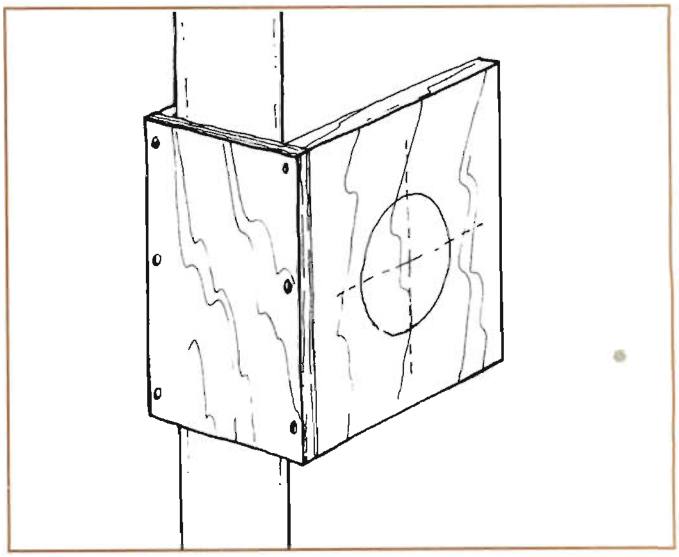
A Better Lathe Sanding Block

You will need a supermarket scrub brush, two standard mousetraps, glue, screws, and about ten minutes. Cut the traps in half and discard the trip wire sections. Then glue and screw the trap sections to the brush as shown in the illustration. The springs act as clamps to hold the sandpaper (or old sanding belts) snugly in place around the bristles of the brush. This tool is hard to beat for irregular turnings, since the bristles "give" on the irregular parts while sanding. The mousetrap clamps allow the sandpaper strip to be replaced quickly and easily.



Holesaw Guide

Ever try to enlarge a door lockset hole to accommodate a new, larger lockset? It's virtually impossible to hold a holesaw steady enough to accomplish the job because there's nothing to guide the centering bit. Using the template pattern that comes with the lockset, lay out the hole diameter on two side guides made of scrap wood. Use the hole saw to bore through these two pieces, and nail an end cap to them. Clamp the jig securely in place, and let the templates guide the saw through the door, enlarging the original hole.



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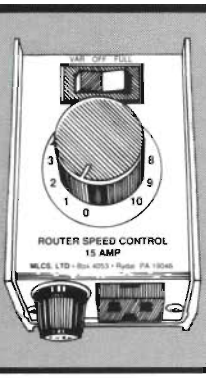

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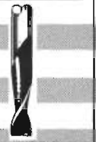
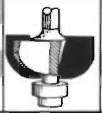
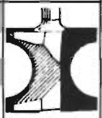
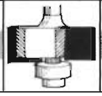
#601	Solid Carbide	1/8" **Spiral Cutter**		1/8"	1/2"	1/4" *	$ 9.00
#602		3/16" Spiral Cutter		3/16"	5/8"	1/4" *	$12.00
#603		1/4" Spiral Cutter		1/4"	3/4"	1/4"	$12.00
#903		1/4" Spiral Cutter		1/4"	3/4"	1/2" *	$12.00
#904		3/8" Spiral Cutter		3/8"	1"	1/2" *	$24.00
#905		1/2" Spiral Cutter	*Proper Adaptor Will Be Supplied	1/2"	1 1/2"	1/2"	$29.00
#350		1/8" **Round Over**	1/8" R	3/4"	3/8"	1/4"	$11.00
#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	$12.00
#353		5/16" Round Over	5/16" R	1 1/8"	1/2"	1/4"	$14.00
#209		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	$15.00
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	$21.00
#199		**Multiform Moulding**	Unlimited Patterns	2 1/4"	2"	1/2"	$40.00
#340		1/8" **Cove**	1/8" R	5/8"	3/8"	1/4"	$12.00
#205		1/4" Cove	1/4" R	1"	1/2"	1/4"	$12.00
#206		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	$14.00
#208		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	$26.00
#460		1/4" **Bull Nose**	1/4" Dia. of Circle		3/8"	1/4"	$14.00
#461		3/8" Bull Nose	3/8" Dia. of Circle		3/4"	1/4"	$15.00
#462		1/2" Bull Nose	1/2" Dia. of Circle		7/8"	1/4"	$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1 1/8"	1/4"	$19.00
#506		1/2" **Pattern**	Flush Trim	1/2"	1"	1/4"	$15.00
#507		5/8" Pattern	Flush Trim	5/8"	1"	1/4"	$16.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	$17.00
#366		1/8" **Slot Cutter**	3/8" Deep	1 1/4"	1/8"	1/4"	$14.00
#368		1/4" Slot Cutter	3/8" Deep	1 1/4"	1/4"	1/4"	$14.00
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#211		3/8" Core Box	round nose	3/8"	3/8"	1/4"	$10.00
#212		1/2" Core Box	round nose	1/2"	11/32"	1/4"	$13.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	$15.00
#213		1" Core Box	round nose	1"	3/4"	1/2"	$17.00
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#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	$ 6.50
#217		7/16" Straight	plunge cutting	7/16"	1"	1/4"	$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	$ 7.00
#775		1/2" Straight	plunge cutting	1/2"	2"	1/2"	$14.00
#218		5/8" Straight	plunge cutting	5/8"	1"	1/4"	$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	$ 9.50
#220		1" Straight	plunge cutting	1"	1 1/2"	1/2"	$11.00
#500		3/8" **Flush**	**Trimming**	3/8"	1/2"	1/4"	$ 7.00
#502		1/2" Flush	Trimming	1/2"	1/2"	1/4"	$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	$ 8.00
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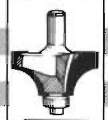
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	$29.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	$29.00
#450		1/8" **Beading**	1/8" R	3/4"	3/8"	1/4"	$11.00
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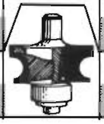
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#530		3/16" **Edge Beading**	3/16" Dia. of Circle		1/2"	1/4"	$15.00
#531		5/16" Edge Beading	5/16" Dia. of Circle		1/2"	1/4"	$15.50

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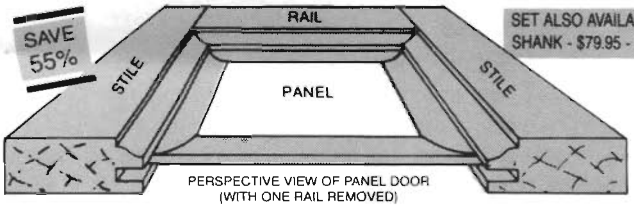
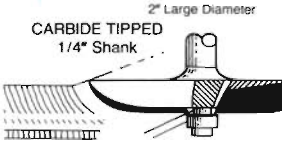


PERSPECTIVE VIEW OF PANEL DOOR
(WITH ONE RAIL REMOVED)

RAISED PANEL BIT
SUPPLIED WITH
BALL BEARING



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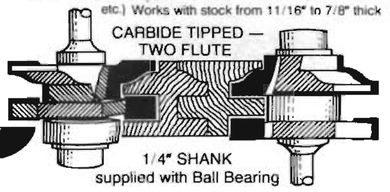

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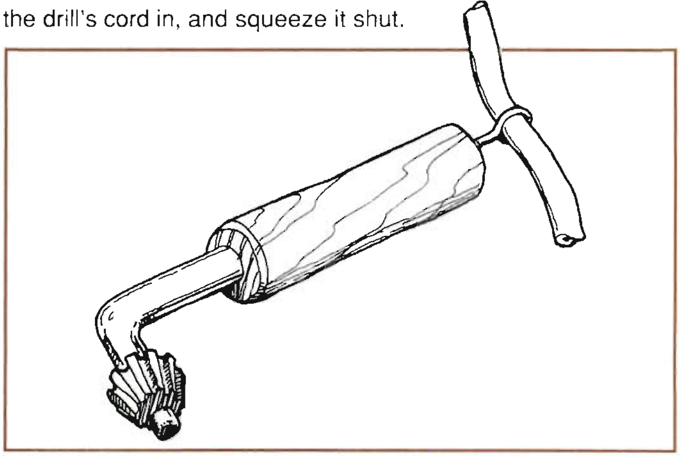
Tricks of the Trade

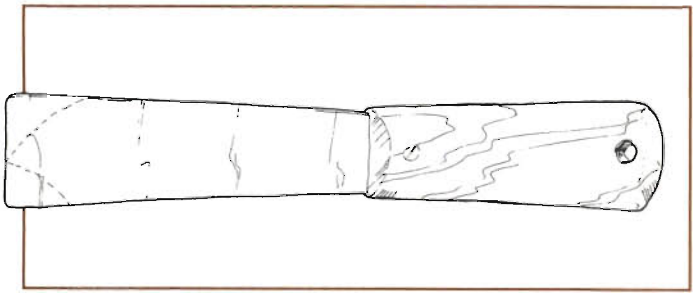
Handling the Chuck Key

You'll find it harder to lose your chuck key, and easier to lever it in the chuck, if you make a handle for it from a hardwood broomstick. Cut a piece 4" to 6" long, and drill a hole in the end of it slightly smaller than the chuck key. Smear a little epoxy on the end of the key and force–fit it into the hole. Then fit the rounded end of the handle with a screw eye. Pry open the screw eye, slip the drill's cord in, and squeeze it shut.



Improved Putty Knife

A standard small putty knife of good quality can be specially improved for cabinet and craft work. Usually the blade is shaped for all–around jobs, and sometimes causes frustration when it won't reach into tiny corners. Carefully grind the blade as shown by the dotted lines in the drawing. Quench it frequently so you don't draw the temper. This "butcher knife" outline is great for reaching into tight corners. The point need not be dangerously sharp; it can even be slightly rounded. Remove any burrs, and you have a putty knife you'll really use.



Putty Tricks

When wood putty becomes dry in the can, don't throw it away, add a small amount of lacquer thinner and it will soften up ready for use again.

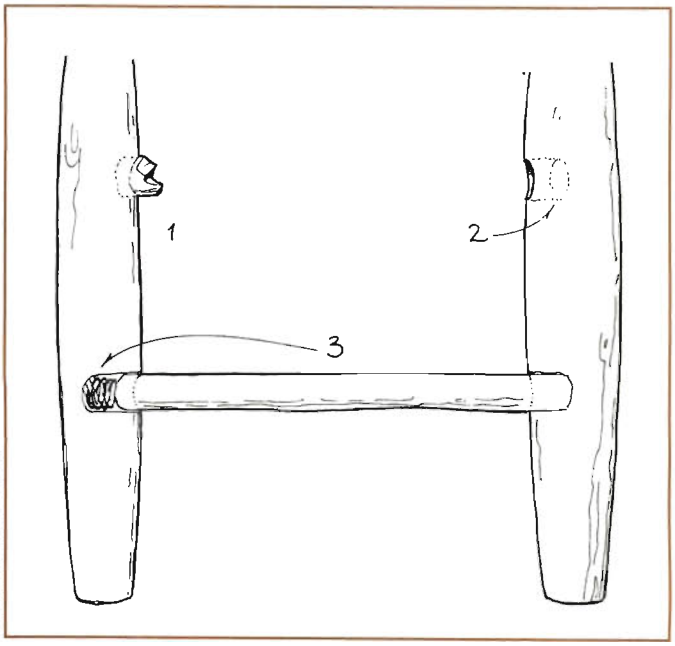
Matching the filler to the wood: Often craftsmen will reach for a can of white pine wood putty to use on pine knots. But take a good look—knots are not the color of the surrounding wood; they often are walnut or mahogany–colored, and one of the wood fillers in these shades works much better to really hide mistakes.

Making your own wood putty: You can stock every known shade made by every known wood putty manufacturer and still miss the correct shade for a particular project. Here's how to mix your own accurate shade: If you own a dustless belt or orbiting sander, carefully turn the cloth pickup bag wrong–side–out and using your shop vac, clean any residue therein. Replace the bag, and sand a portion of the project or (preferably) some of the scrap with your sander. If the sander is not fitted with a dust pickup, place your stock on a large sheet of newspaper or wrapping paper to "catch" the dust. Collect the dust in empty jars (such as baby food jars), and apply a label as to the kind of wood for future reference.

For a quick–dry solution: mix sander powder with cellulose (wood type) model airplane cement to a thick paste and apply. Since the cement will harden, this is only good for a one–time application.

Setting Blind Dowels

Side rails dowelled into a leg often break or shear off right at the joint, and they're just about impossible to refit without taking the project apart. If the piece can be moved clear enough to remove the broken bits of dowel from the leg and side rail, re–drill the hole in the side rail deep enough so that the whole dowel and a small, fairly stiff spring can fit into the hole. Push the new dowel, with glue applied for both holes, all the way into the deeper hole. Position the parts, and let the spring push the dowel partially back out and into the second hole. The spring, of course, remains in the hole.



Illustrations by Graham Blackburn

Fluorescent Fix–It

When your overhead fluorescent light begins to flicker, it's not only nerve–wracking, but can cause a stroboscopic effect when you're working on the lathe. If no new tube is immediately available, turn off the light switch and remove the troublesome tube. Reverse and re–insert it. Generally the faulty tube will "come back to life" and not flicker until you can replace it.

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by Joseph Beals

Notes from the One–Man Shop

Many of us who began as cellar amateurs *will recall* the exhilarating and terrifying move to professional work. For those who haven't experienced the thrill, I'll try to relate it here. It is the artisan's loss of innocence, a transition unique to the one–man shop. The ideal is to preserve the pure pleasure of woodworking in the face of quixotic customers, the demands of business management, and the moral challenge of turning artistry to reliable income.

I was a novice with limited tools, no formal training, and no friends in the trade, when I was asked by a neighbor to build a series of cabinets and bookcases along two adjacent walls of their living room. Their house had suffered fire damage some months before, and from the debris they had salvaged the living room's wide pine floor boards. It was their notion to return this wood to the room in the form of cabinetry. I agreed to take the job.

Old wood is a singular material. These two hundred year old boards had a priceless color and texture; they also had accumulated an appalling volume of varnish, paint, sand and nails. They were rough sawn on the bottom, and varied in thickness from a tight half inch to a strong seven eighths. The effort required to transform them into traditional raised panel cabinetry was made feasible only by my naive innocence. By the end of the job I had a profound respect for the value of sharpening tools, and I was learning the critical art of making mistakes, then making them disappear.

When the stain and varnish went on, the old wood became radiant, almost three–dimensional, and the ordeal seemed worthwhile. The customer was very pleased and paid my bill on the spot. My net wage came to less than four dollars an hour, but I had survived a rough baptism with my faith intact.

That was eight years ago. Since then, I have added a few critical tools to my shop, stayed clear of used wood, and developed a growing base of regular customers. I have built a lot of kitchen cabinetry, and the usual assortment of chests, tables, bookcases and other staples of the trade. I work primarily in hardwoods in traditional styles, but I am still a neophyte. The more I do, the more there is to know, but I have acquired a few useful skills in the art of offering myself for hire.

Beyond the Call of Duty

Customers who come to me for cabinetry or design advice have one principal goal: they want to hire me to create something for them. They are not concerned with the nuances of joinery, the behavior of woods, or the problems of installing built–in cabinetry in an old house. They have an idea, or a vision, and they want it rendered in a finished product. In the case of kitchen cabinetry, which comprises about half my work, this means juxtaposing the pleasure of cabinetmaking against the often ugly job of preparing the site.

In the old houses of New England, replacing kitchen cabinets can require extensive remodeling to repair rotted or inadequate framing, dead plaster, bad wiring or plumbing, and it means a constant struggle with wildly sloping floors and ceilings. Because most of my early work was for friends and neighbors on tight budgets, I formed the habit of doing everything myself. Although I would often spend more time preparing the site than making cabinets, I found a peculiar satis-

This set of cabinets and bookcases was the author's first project as a professional woodworker. Made from salvaged floor boards from his client's fire–damaged house, it was his first—and last—experience working with used wood.

Joseph Beals *is a woodworker in Marshfield, Massachusetts.*

faction in being the sole creator of the finished job.

On a job several years ago, I undertook to remove a failed marriage of steel and plywood cabinets, and replace them with raised panel maple cabinets and marble counters. The kitchen was in the ell of an old Greek Revival house, beautiful outside and badly decayed within. Before I was done, I had built an entryway with stone foundations and exterior trim to match the house, removed an existing entry, replaced a 4 X 6 corner post and twenty feet of 6 X 6 sill, replaced five massive floor joists, installed seven new windows, rebuilt an exterior wall, and replaced most of the ceiling. I rewired the room, moved water, steam, gas and drain pipes, and installed a quarry tile floor. The job took a year, out of which I spent a month making maple cabinets from trees I had cut three summers before, and fitting marble counters which had previously been part of a men's lavatory at Harvard University.

This job was more involved than most, and it stretches the limits of what a cabinetmaker will do to find a place for his work, but it illustrates a useful point. Cabinetmaking need not be an exclusive occupation if related work is within the cabinetmaker's range of experience. Even if most of us prefer not to do much carpentry, it can be fruitful to take it on as a convenience both to the customer and to ourselves. I admit to frequent irritation when I hang drywall, which I dislike, or when I sweep rat skeletons or a ten-year-old lunch out of old insulation, but the annoyance of dealing with professional subcontractors can be far worse. Tradesmen, *as distinct from artisans and craftsmen,* seem to lack any sense of dedication and pride, and their work habits can be a terrible nuisance. Although I now contract all plumbing and most electrical work, I still do almost everything else. Not only do I prefer to build cabinetry in a room prepared to my standards, I can also give customers the freedom to change plans as they see how the work progresses. For many people this is a rare luxury, and the benefits will ultimately accrue for the cabinetmaker who makes such a convenience possible.

What happens when a customer calls to offer work that does not involve cabinetry? A customer for whom I had built red oak kitchen cabinets with ceramic tile counters asked me to rebuild and tile a bathroom. This is a typical example of cross-reference work, and it can pose a real dilemma. Tile work on its own does not appeal to me, and bathroom remodeling is surely the most unpleasant of all jobs. If I have no time available the problem resolves itself, but without that convenient escape I feel obliged to earn a wage as it comes. I took the job, and suggested a plan that included a panelled red oak vanity and a panelled enclosure for a fluorescent lamp overhead, thus bringing some woodworking into the project. The customer was very happy, and has since called again to offer more satisfying work elsewhere in the house. As is often the case, doing an unpleasant job became an investment which has paid off well.

Dealing with Clients

Customers who come to a local craftsman rather than to a commercial business fall in two categories. Most are people who take pleasure in fine woodwork, and who prefer traditional craftsmanship rather than fast, shoddy results. But some are only looking for a mechanic to do a job, on the presumption that a local man or woman will be cheaper and more accountable than a large commercial business. The presumption may be accurate in whole or in part, but these customers are after a bargain, not an artist. They are typically oblivious to details of workmanship, and they nag incessantly if the job takes even a day longer than they think it should.

Because self-centered, annoying clients are inevitable, it is vital to have a defense ready. The one that works—the only one—is to imagine that the customer really does care, and do as faultless a job as possible. While this very wholesome advice looks morally tidy on the printed page, it can be a terrible burden in the heat of distress. But a piece of fine woodworking will last far longer than a vacuous, ill-tempered client, and someone will eventually appreciate it. Small comfort at the moment, perhaps, but most of us expect our work to last forever. That is our legacy.

Some customers will become involved almost to a fault. They fuss and fidget over the most minute details; they prescribe methods of joinery, design, or finishing whether they understand them or not, and they will specify materials and techniques that range from the silly to the bizarre or impossible. Though I prefer to work without a steady stream of instruction and advice, I have a private respect for customers who take so much interest. They are spending their money, often a lot of it,

This job turned out to require more than just building the maple cabinets with marble countertops. The whole room had to be gutted, rewired and replumbed, and the ceiling and several floor joists replaced.

photos by the author

for an addition to their home, and it is hard to begrudge them a passionate involvement in the process.

I supplied an assortment of finish samples to a customer who wanted a large order of black cherry cabinetry. The sample he chose was finished with wax over shellac, which I deemed entirely suitable for the purpose. He never asked what the finish was, because he assumed it to be polyurethane, for which he has a particular affinity. I learned this only later, when he remarked how well the finish has worn for the last several years. He attributed the durability of the finish to the wonderful power of polyurethane, and I dared not destroy his faith. I do not use polyurethane, and in fact dislike it, but a moral deceit seems appropriate. It seems reasonable to avoid a conflict based on an arbitrary preference rather than on the actual performance of the finish, when the chemistry of the finish had never been specified.

Another customer, on the basis of advice from a friend, specified particle board as a countertop substrate. I do not use particle board for anything, and especially not on counters. I declined with a careful explanation, and the customer agreed to have plywood.

Some matters are not so easily resolved. A customer ordered a free–standing cabinet and bookcase in panelled birch, but after the deal had been struck, she informed me that she wanted the cabinet doors done in a birch finished plastic laminate instead. I declined politely, suffered some mild abuse, and the job was off.

I usually accommodate requests that do not conflict with good woodworking practice, but if a request is esthetically revolting, I try to suggest alternatives. A surprising number of customers make peculiar requests just to be involved, and they are often willing to consider other options. But when a customer insists on anything that is fundamentally unsound, there is no alternative but a hasty retreat. No matter how much the customer believes in the virtue of his idea, it is the unhappy cabinetmaker who will be held accountable for the result.

Any job can give rise to complaints, and a majority of customers, whether their complaint is small or large, will be much relieved by a sympathetic hearing and a prompt response. Most complaints will be something trivial. One customer was disturbed at the apparent misalignment of pulls on adjacent cabinet doors, and he demonstrated the fault by using a box of biscuit mix as a straightedge. A steel square revealed the biscuit box to be the problem, and the matter was concluded.

Some complaints are esthetic and have no solution. A customer was unhappy with the strong grain pattern on the panels of a pair of white oak doors. He had developed a taste for oak through his experience with oak grained plastic laminate, and he found solid hardwood bolder and more lively than his taste could accept. He calmed down after a brief discussion, but I suspect he still questions the pedigree of natural

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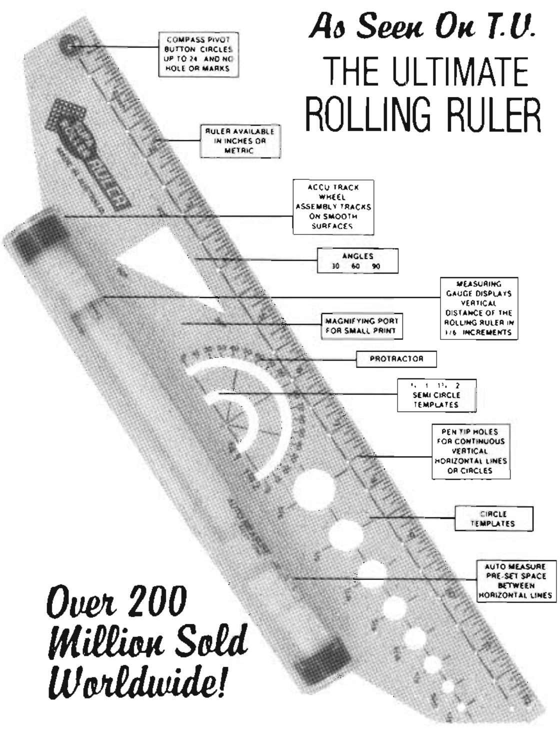
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wood. Another customer specified a hard finish inside drawers, so I applied two coats of gloss varnish. The odor lingered for a few weeks and offended his wife, who demanded that the drawers be replaced. I advised her to wait a month, which she did, and the odor vanished. Complaints are inevitable, and from the customer's point of view, they are always legitimate. A quick, sympathetic response and a tolerance for silliness will resolve most of them.

A Fair Wage

No matter what you have read or been told, estimating is not a science, and it cannot be reduced to a formula. The most diligent attempt to make an accurate estimate will fail as often as it succeeds, but clients who ask for an estimate—as most will—deserve an honest effort to establish a base price. The old joke about estimating is still useful: make the most careful analysis possible of time and materials, then double that price to break even. Triple it if you expect to make a profit. There is also a rough guide—very rough—that carpenters sometimes use: the price of labor will be three times the cost of materials. These country maxims are amusing, but they can be frighteningly accurate.

I estimate first by analysis, then by intuition. The intuitive estimate is usually higher by twenty to thirty percent, and has so far proved the most reliable. Because customers tend to regard an estimate as a firm price, I add a percentage before the fact to shore up the guesswork, then stay with the final figure unless the job gets way out of hand. Customers will usually pay for unexpected problems or significant changes of plan, but they will not have sympathy when an estimate was simply wrong. Any attempt to compensate for a bad estimate by raising the final price will generate ill will far in excess of the loss—if not at the moment, then certainly in the value of future work that will go to someone else. In the long run, underestimated jobs will be offset by jobs that return more than expected, and a satisfied clientele will provide adequate insurance *against* occasional losses.

Lawyers advise that everything should be in writing. I rarely put anything in writing but a final bill. This would be poor policy for a commercial business, but for most of my customers it is the only reasonable approach. Any attempt to forecast a complex job on paper is as likely to fail as a complex estimate; the only result is the headache of doing more desk work than woodwork. Most customers are much more interested in what gets done than in a catalogue of what you propose to do, and a final bill is often the only way to sum up a job. This approach is doubtless a travesty of legal first principles, but my experience has so far justified my faith. An unreasonable customer will make trouble *in spite* of documentation, and the vast majority of honest, reasonable customers are happy enough to agree on a verbal contract with

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T100B	Corner Rounding	1/8	3/4	5/16	1/4	1-1/4	10.00
T101B		3/16	7/8	3/8	1/4	1-1/4	10.00
T102B		1/4	1	7/16	1/4	1-1/4	11.00
T103B		5/16	1-1/8	1/2	1/4	1-1/4	12.00
T104B		3/8	1-1/4	5/8	1/4	1-1/4	14.00
T105B		1/2	1-1/2	3/4	1/4	1-1/4	16.00
T110B		1/2	1-1/2	3/4	1/2	1-1/2	16.00
T111B		5/8	1-3/4	7/8	1/2	1-1/2	19.00
T112B		3/4	2	1	1/2	1-1/2	20.00
T113B		1	2-1/2	1-1/4	1/2	1-1/2	32.00
T200B	Beading	1/8	3/4	5/16	1/4	1-1/4	10.00
T201B		3/16	7/8	3/8	1/4	1-1/4	10.00
T202B		1/4	1	7/16	1/4	1-1/4	11.00
T203B		5/16	1-1/8	1/2	1/4	1-1/4	12.00
T204B		3/8	1-1/4	5/8	1/4	1-1/4	14.00
T205B		1/2	1-1/2	3/4	1/4	1-1/4	16.00
T210B		1/2	1-1/2	3/4	1/2	1-1/2	16.00
T212B		3/4	2	1	1/2	1-1/2	20.00
T901B	Cove	1/4	1	3/8	1/4	1-1/4	11.00
T902B		3/8	1-1/4	1/2	1/4	1-1/4	12.00
T903B		1/2	1-1/2	5/8	1/4	1-1/4	13.00
T904B		1/4	1	3/8	1/2	1-1/2	11.00
T905B		3/8	1-1/4	1/2	1/2	1-1/2	12.00
T906B		1/2	1-1/2	5/8	1/2	1-1/2	13.00

Tool No.	Diagram	Radius/ Angle	Cutting Dia.	Cutting Len.	Shank Dia.	Shank Len.	Price
T301B	Roman Ogee	5/32	1-1/8	15/32	1/4	1-1/4	15.00
T302B		1/4	1-1/2	21/32	1/4	1-1/4	16.00
T303B		5/32	1-1/8	15/32	1/2	1-1/2	15.00
T304B		1/4	1-1/2	21/32	1/2	1-1/2	16.00
T1501B	Slot Cutter		1-1/4	1/8	1/4	1-1/2	9.00
T1503B			1-1/4	1/4	1/4	1-1/2	10.00
T1506B			1-1/4	1/2	1/4	1-1/2	11.00
T1512B			1-1/4	1/2	1/2	1-1/2	11.00
T601	Core Box		1/4	1/4	1/4	1	9.00
T602			3/8	3/8	1/4	1	10.00
T603			1/2	3/8	1/4	1	12.00
T604			5/8	5/8	1/4	1-1/8	13.00
T605			3/4	5/8	1/2	1-1/2	14.00
T1602	Dovetail		1/2	1/2	1/4	1-1/4	5.00
T1604			3/4	3/4	1/2	1-1/2	6.50
T1606			1	7/8	1/2	1-1/2	7.50
T1607			1/2	1/2	1/2	1-1/2	5.00
T2201s	1/4" Straight Bit Single flute Double flute		1/8	1/2	1/4	1-3/16	5.00
T2202s			3/16	1/2	1/4	1-3/16	5.00
T2205d			1/4	3/4	1/4	1-3/16	5.50
T2207d			3/8	1	1/4	1-3/16	5.50
T2209d			1/2	1	1/4	1-3/16	5.50
T2211d			5/8	3/4	1/4	1-3/16	6.50
T2212d			3/4	3/4	1/4	1-3/16	7.50

Tool No.	Diagram	Radius/ Angle	Cutting Dia.	Cutting Len.	Shank Dia.	Shank Len.	Price
T2313	1/2" Straight Bit		1/2	1-1/4	1/2	1-1/4	5.00
T2317			5/8	1-1/4	1/2	1-1/4	6.00
T2318			3/4	1-1/4	1/2	1-1/4	8.00
T2501B	Cove Beading	3/16	1	1/2	1/4	1-1/4	12.00
T2502B		1/4	1-1/8	9/16	1/4	1-1/4	13.00
T2503B		5/16	1-1/4	5/8	1/4	1-1/4	14.00
T401B	Chamfer	45°	1	3/8	1/4	1-1/4	11.00
T403B		45°	1-3/8	5/8	1/2	1-1/4	12.00
T2004B	Straight Bit w/ Bearing Guide		1/2	1	1/4	1-1/4	7.00
T2008B			1/2	1	1/2	1-1/4	7.00
T701	V Groove		3/8	1/2	1/4	1	8.50
T702			1/2	1/2	1/4	1	9.50
T2101	Mortising		1/2	13/32	1/4	1	6.00
T2102			5/8	9/16	1/4	1-1/4	7.00
TC-12B	Classical	3/16	1-3/8	11/16	1/4	1-1/4	18.00
TC-12B 1/2		3/16	1-3/8	11/16	1/2	1-1/2	18.00
TC-16B		1/4	1-5/8	13/16	1/4	1-1/4	19.00
TC-16B 1/2		1/4	1-5/8	13/16	1/2	1-1/2	19.00
T1701	Panel Pilot w/ Drillpoint		1/4	3/4	1/4	1	6.50
T2601	Keyhole (T.C.T.)		3/8	3/16	1/4	1	7.50

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The Business End continued

room for both sides to negotiate along the way. An attorney told me I was naive and idealistic, and he was right.

Customers will call, arrange a plan and a commitment of time, then change their mind entirely, or just vanish from the face of the earth without a trace. Customers will promise to decide on an estimate next week, and call three weeks later anxious for work to begin at once. Customers will pause in the middle of a job to eliminate some substantial component they no longer like, or they will double the work with a shopping list of bright ideas and an encouragement to squeeze everything in. And so, like the airlines, we must overbook our clients.

It is not possible to avoid overbooking and keep busy, and the necessity of overbooking means that inevitably there will be delays in scheduling. Although I often have work commitments six to nine months ahead, I rarely schedule more than eight weeks ahead, and even that is stretching the limits of reason. Customers who want me badly enough are always willing to wait, and those who can't wait, don't. Simple.

Although most customers expect us to be busy, and indeed would be wary of anyone who was always available, they do not expect to be treated casually. For most of us, any particular client is just one of many, but for our clients, the relationship is them and us, one on one, and they expect at least a token acknowledgement of that fact. Nothing will annoy them more than telephone calls not returned, or home visits arranged and subsequently ignored. Because customer relations in the one–man shop are more personal than in a commercial business, we owe our customers the regular habit of courtesy.

Within the past year I worked for several months on five jobs simultaneously. All of them involved a combination of field work and shop time, which provided a ready excuse for not being on the site everyday. I juggled jobs like a madman, and did enough for each client that they all saw steady, if slow progress. I made a point of keeping them all informed with a flexible version of the truth, and if results were not coming as quickly as they wished, at least they knew where they stood. Since overbooking is a necessity, not a fault that demands a cure, telephone time is a vital investment in goodwill. Some customers will take offense regardless, but they come as part of the package. They are knots in the wood, and if we can't cut them out, we work around them.

Turning an avocation to a profession has substantial rewards, but it will mean negotiating the legitimate demands of clients who have no obligation to understand the vagaries of a one–man business. The chief difference between the professional woodworker and the talented amateur is not quality of work, but the added duty of public relations. By treating every customer with sympathetic courtesy, and learning to manipulate their interests in a creative, practical fashion, it is possible to maintain a high standard of performance and still preserve the pure pleasure of fine woodworking. PW

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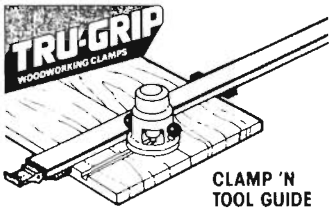
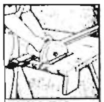


CLAMP 'N TOOL GUIDE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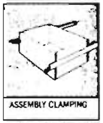
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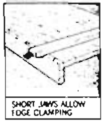
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You've heard of "the woodworker who was a real butcher." It's true for many years I *was* a meat cutter in a butcher shop in Erie, Pennsylvania. But several years ago the poor economy in the Erie area forced me to look for a new job.

I looked for months. Nothing was available. My situation was so bad we were getting calls from collection agencies. Each time the phone rang my wife would begin to cry.

I was sitting at the kitchen table very late one snowy night in December. I couldn't sleep, my checkbook was overdrawn, bills were piling up and the bank was threatening to foreclose on our home.

While I was sitting there, I began remembering the advice a very successful man by the name of Ed from Waterford, Pennsylvania once gave me. He said, "Rick, If you want to succeed, make a living, don't just earn a living. In other words, work for yourself, BE YOUR OWN BOSS." This man should know! He was 89 years old and a self-made millionaire.

"Make a living?" That night it came to me. For years my wife, Amy, and I went to all the local craft shows. We loved them. We admired the beautiful handmade woodcrafts. Fact is, I've enjoyed woodworking ever since I was a boy. I told Amy many times, "When I retire and have more time I want to make handmade wooden toys and gifts."

It was just before Christmas and there were many local craft shows, so we started going to each of them. We watched what items were selling well and asked a lot of questions. After gathering all the information we could, we went to work.

In an abandoned pigeon coop with an old borrowed saw and some scrap lumber, we designed seven very unusual items, among others, which we thought would have great sales appeal. After cutting each on our old band saw, hand sanding them smooth and painting them in many colors, we loaded them into our old Chevy station wagon and went to our first craft show in Waterford, Pennsylvania.

We were so excited we arrived an hour earlier than the rest of the crafters to make sure we were ready before the show started.

Amy and I sat in our booth anxiously watching the people look at our handmade woodcrafts. A well dressed lady in a red dress picked up one of our blue cat doorstops and said, "Oh, how cute. This is just what I've been looking for." Our first sale, $9.95. That was just the start. Next we sold one of our Canadian geese items for $5.95, then two unique toy trucks to an elderly lady who wanted to give them to her grandson.

At the end of the day we looked into our cash box. We'd made over $600!

We were so happy we treated ourselves to a prime rib dinner for the first time in fourteen months!

We have some friends, Bob and Nancy Williams, from Fairview, Pennsylvania. Bob is a 25-year-old school teacher, so of course they needed an extra income to help with the family expenses. Bob asked me if I would help them get started with a money making woodworking business.

Amy and I spent several weeks helping them turn their garage into a workshop. We gave them many designs which were very profitable for us, and information on which shows to attend.

Now, eighteen months later, they have a very successful craft business attending shows in the summer months when Bob isn't teaching. Nancy keeps the business going in the winter attending the local Christmas shows and filling mail orders.

This isn't some kind of "Get Rich Quick" deal. No way. There's *plenty* of room for *everyone* in crafting. I won't be competing with you and you won't be competing with me. That's why Amy and I would enjoy showing you how you can start your own craft business using your basic woodworking and painting skills. You can go as far as you want... *profits are virtually unlimited!*

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The Finishing Forum

The Finishing Forum is an ongoing discussion about the art of wood finishing. If you have a question or a problem to solve, we'd *like to help*. If you have a tip or a secret formula to share or if you've recently tried a new finishing product, write to: The Finishing Forum c/o *Popular Woodworking*, 1320 Galaxy Way, Concord, CA 94520. Letters may be edited for publication.

Reader Feedback

Source Assistance

As an avid woodworker and a retired biologist, perhaps I can help in suggesting a source of supply for Haematoxylin (the spelling I am more familiar with). George Frank described it in your November Issue ("Staining Maple") as hard to locate.

Haematoxylin in various formulations is probably the most common dye used in routine staining of thinly sectioned animal tissue for microscopic examination. Many high school biology teachers and certainly any public health laboratory or college biology department could advise of a supplier. A scientific supply house, listed in the yellow pages under "Laboratory Equipment and Supplies," would be a more likely and cheaper source than a drugstore.

In ordering, it is important to specify the basic dye and to avoid prepared formulations which are likely to carry the inventor's name such as Harris's, Ehrlich's or Heidenheim's Haematoxylin.

Roy E. Drinnan
Musquodoboit Harbour, Nova Scotia

Another Cause of "Fisheyes"

In the answer to Ken Irvin ("Something Fishy," *The Finishing Forum, PW #57*) regarding "fisheyes" in varnish, you missed one possibility of silicon contamination: hand lotions.

We had to be extremely careful of these at McGowan Cabinets in Forest Lake, MN, where I used to work. We lacquered new work—chiefly oval picture frames and many types of straight mouldings.

Florence Cox
Prescott, Arizona

Questions and Answers

A Successful Mission

I am about to make some "mission" furniture which I have fallen in love with lately. The construction of the pieces I have in mind seems simple enough. I have read H.H. Windsor's book *Mission Furniture: How to Make It*, but it was published around 1910 and suggests as an oak stain the use of catechu, whatever that is, treated with "a solution of bichromate of potash," all of which seems pretty medieval to me.

What I want to know is: did Gustav Stickley and his followers fill their oak pieces? Was mission furniture always stained? Was the depth of the stain uniform or were chairs, for instance, darker or lighter than, say, tables? Lastly, could you suggest some stains (manufacturers, colors, etc.) I might use?

Albert DiBartolomeo
Philadelphia, Pennsylvania

Due to my European background I have no experience with "mission" furniture. So, before answering your letter, I decided to investigate the subject. I finally located an antique dealer who told me that he had, in stock, nearly 200 mission pieces. He certainly did! Mr. D. Magner, owner of the store located at 309 Henry St., Brooklyn, and his assistant, David Allen who does the actual refinishing of the mission pieces, were both extremely knowledgeable about mission furniture.

Thanks to them, and a good deal more research in the direction they pointed me, I can confidently answer your query on the proper way to finish mission furniture.

All mission furniture was not finished the same. The colors vary from light brown (toast color) to dark blackish–brown. The finishes vary, too. The best pieces have a very pleasing, extremely smooth surface that was apparently achieved by fine sanding and finely rubbed coatings. Others were not so smooth; neither the sanding nor the finish rub had been done well. In this group, some had filler, some not.

To duplicate the finish of the better mission style furniture I would suggest that you first (as I always do) experiment on samples. Soak these samples with plain commercial ammonia; that was definitely one of the ingredients early finishers used for coloring. Also try a weak solution of bichromate of potash (100 grams in a liter of warm water), with walnut crystals. Among these three you will very probably obtain the basic color you want.

The most unpredictable of the three is the bichromate; it will act differently on different woods. To compensate for the difference, the turn–of–the–century craftsman pre–stained the wood with catechu extract or logwood extract also known as campeche; there is a modern, refined version called hemotoxilin (see "Source Assistance" above). On pre–stained wood, the bichromate produces deeper colors, so it should be watered down until the proper shade is attained. The basic color is then modified further with the application of a filler stain, and still further with a colored wax.

The filler stain is quite simple. Take powdered whiting and mix it with asphaltum paint; then liquefy it with mineral spirits. Whiting is a powdered limestone consisting mostly of fossil shells; asphaltum paint is a by–product of oil refining (calling it liquefied tar is close to the truth). When mixed with whiting, it colors the whiting and makes an excellent filler. The tinted whiting will partially fill the pores and the asphaltum paint will give a pleasant hue to the oak. Be sure to rub off all excess filler with a rough rag.

The final finish can be either varnish or shellac; I saw pieces finished both ways. Whichever finish is used, after the final rubbing the pieces were more frequently than not treated with tinted wax. Research indicates that the wax was tinted red with alcanet root soaked in the turpentine that was then used to melt the wax. Nearly all of the mission pieces I have seen have this faint reddish glow.

George Frank

***George Frank** trained in the great wood finishing shops of Europe during the 1920's and 30's. Over the next 40 years he ran his own shops in Paris and New York. He is the author of* Wood Finishing with George Frank *(Sterling Publishing Co., 387 Park Avenue South, New York, NY 10016-8810).*

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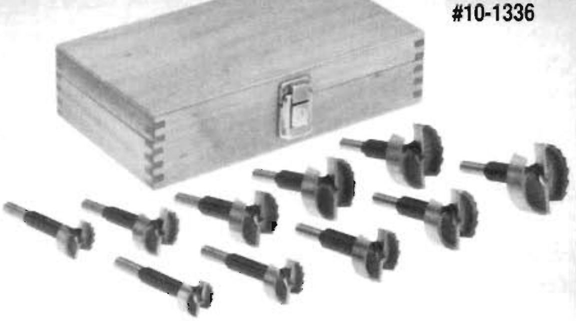

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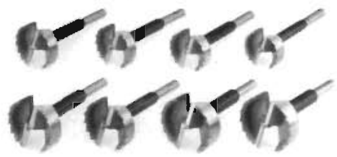

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Book Reviews

by Hugh Foster

After reading a recent issue of *Popular Woodworking*, a friend commented, "Foster, haven't you ever read a woodworking book that you didn't think we should buy?" Yes, of course, but there are so many good ones I don't need to review anything lesser unless it's a real rip–off. My reviews are usually purchase recommendations. Right now, however, I'd like to deal with the most blatant rip–off I've seen in recent publications.

A review copy of **How and Where to Get Free Wood for your Home Shop Projects** recently arrived at *Popular Woodworking*. The publisher suggested that he'd advertise in the magazine in exchange for a favorable review, which strikes me as dishonest, especially when the work is barely more than a long magazine article. Its $14^{1}/_{2}$ pages of double–spaced type would yield about five magazine pages of the type you're reading right now. If the information were valuable I'd have no complaint about the $9.95 cover price, but it mainly consists of tips like "Gather skids and pallets." Now, by the time you've pulled them apart and removed the nails, cut around the nail holes to get the pieces you need, and glued both lengthwise and edgewise to get your panels, you'll have spent more in glue and time then you would have for the wood. Buyer beware. The author and publisher appear to believe that there's a sucker born every minute, and that a whole bunch of them are woodworkers. I'm omitting the author and publisher of this one specifically to help you avoid it. If the title sounds too good to be true, it probably is.

Fine Woodworking Design Book Five (Taunton Press, 63 South Main Street, Box 355, Newtown, CT 06470-5506) 186 pp., paperback, $19.95

The direction of this volume is indicated by its opening quotation—"I made my things because they weren't here. I knew that if I didn't make them they would never be here, and I very much wanted them to be here." (Emmett E. Day) These projects really made me stop and wonder. How were they made? Some seem almost superhuman, like the art you might see on a tour of a great museum. Nearly forty pages are devoted to an essay by Scott Landis about the woodworking arts in the Pacific Northwest. The piece is excellent, but I'd rather have had another masterfully photographed forty pages of exquisite woodworking. There may not be a project here that you're likely to copy, but you won't go away from the book uninspired.

Carving Wood Signs by Stephen P. Baldwin. (SignCraft, Box 06031, Ft. Myers, FL 33906) 91 pp., $13.00 paperback

I've read treatments of relief caving that were fancier, more elaborate and exciting than this one, but none better. Baldwin is a professional sign carver, meaning he earns his daily bread doing what he shows us how to do. He knows his craft, and lots of tricks to help the work go better. His suggestions about every aspect of sign carving, from layout through chisel selection to business practice, will be quite useful to readers who want to know more about carving. The section on sharpening is as good as I've ever encountered on the topic of keeping your gouges and skews sharp. The book is small, but Baldwin writes very clearly, and the content is both useful and inspirational.

Band Saw Basics by Mark & Gene Duginske. **Router Basics** by Patrick Spielman. (Sterling Publishing Co., 387 Park Ave. South, New York, NY 10016) Each is 128 pp., $9.95 paperback

For a few years now, Sterling has been publishing a series of *Handbooks* on power tools. While they've been superior to other treatments, they are sometimes pretty advanced. What do you do when you don't want to go through hundreds of pages? Most of the material in their new *Basics* series seems new, and its presentation is more easily understood. At first I was skeptical, but I'll probably be reaching for these books far more often than I will for either of their *Handbooks*. Both books, especially the router volume, are full of jigs and fixtures that will help you get maximum use from these power tools. The brothers Duginske probably know more about the band saw than any other two humans, and Spielman is at his best when discussing routers and router jigs. You're almost sure to be a better woodworker after perusing these volumes.

The Woodworker's Index by Clifford Field. (Pirahna [sic] Publications, Box 930, Leadville, CO 80461) xiv + 52 pp., $12.95 spiralbound paperback

The Woodworker's Index is billed as the ideal way to find just about any woodworking information. Eleven magazines are indexed here from 1985 through the present. The contents are first listed under general categories. The author suggests that to find an article about dining room tables, look first under *furniture*, then under *tables*, and finally *dining*. Sure enough, when I got to dining, there were references to eleven different plans. This book could be very useful, although I foresee some frustration arising from the fact that probably none of us has at hand, or knows where to get, some of the magazines referred to in the *Index*. Still, the possibilities are unlimited—Field could make his excellent index available in computer disk format. After paying an initial price, we'd be able to buy an annual update, and before too many years, we'll be able to look up any woodworking project ever published. Right now, these 104 superbly organized columns of information are sure to drive readers to their library in quest of plans. You need a copy, if not for yourself, for your local woodworker's guild library.

The Marquetry Manual by William A. Lincoln. (Linden Publishing Inc., 3845 N. Blackstone, Fresno, CA 93726) 272 pp., $19.95 paperback

It takes a good bit of gumption to publish a work that so nearly parallels one as fine as Ramond's *Marquetry* (published about a year ago by Taunton). While that book was hardcover, beautifully bound, a work of art in its own right, and extremely expensive, this one is paperback, practical, efficient and affordable. It's illustrated with black and white photos, although there's a nice section in color. The instructions here are very clear. Unlike Ramond's, this is the kind of book I can imagine taking into the shop. PW

Hugh Foster *is an English teacher and a woodworker in Manitowoc, Wisconsin.*

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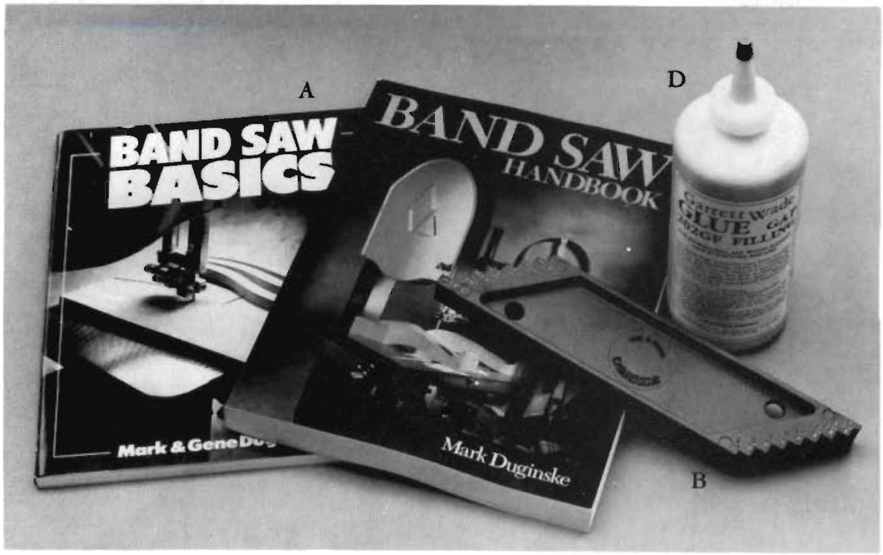

E / The "Blind Nailer" Used To Be A Staple In Every Finish Carpenter's Tool Box

This unique tool allows you to set nails or brads invisibly. Slip the special chisel, with its finger nail shaped cutting edge, into the positioning jig and tighten the clamping screw. Place the flat sole on the wood and strike the end of the chisel with a firm tap with the palm of your hand. The Blind Nailer will lift a perfect small chip from the surface. Hammer your nail or brad in and then glue the chip back in place.

44K01.03	Blind Nailer	$15.95

F / Special Bandsaw "Cool Blocks" Prolong Blade Life & Increase Accuracy

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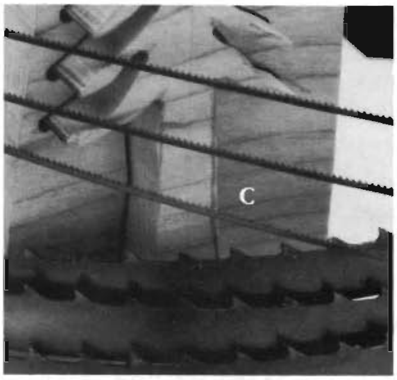
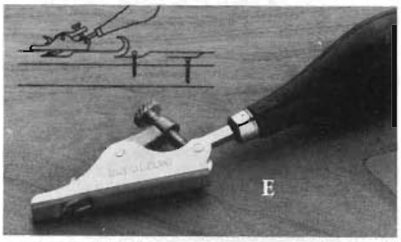
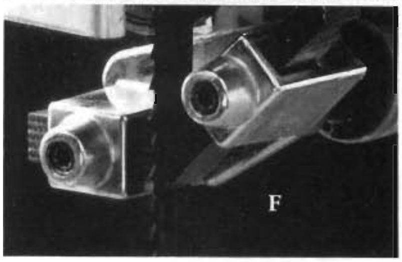
33K09.05	"E" Old Sears (1/4" Rd.)	$11.95
33K09.06	"F" Jet 14" (fits Delta copies)	$11.95
33K09.09	"K" New Tilt-Head Sears	$16.95







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by Graham Blackburn

Clamps, Cramps, & Pinvises

Every woodworker knows "you can never have too many clamps." The truth of this maxim usually hits home right at the moment when you're in the middle of a clamping-up operation and realize you don't have sufficient clamps to do the job. And yet, in any shop that's been around awhile, the number of clamps visible is certain to be awe-inspiring to a novice, who simply can't imagine what all those long pipe things are for.

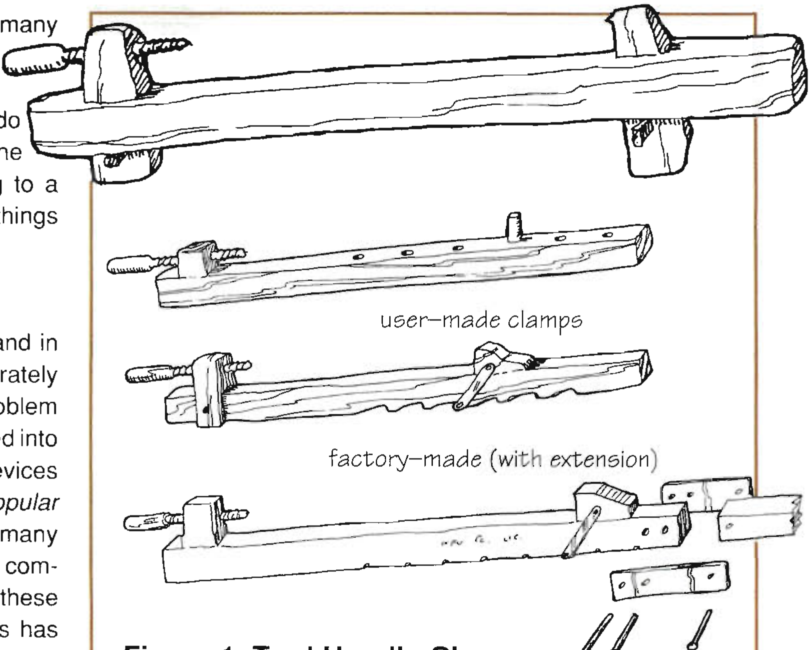


Figure 1. Tool Handle Clamp

Getting a Grip on Things

There's not much that can be done completely freehand in woodworking—it's almost impossible to do anything accurately unless the workpiece is firmly secured. To deal with this problem the standard cabinetmaker's bench has gradually developed into a very efficient holding tool, equipped with all manner of devices for securing the work in progress (Tried and True, *Popular Woodworking* #50, August/September 1989). But there are many occasions when work must be very tightly held—even compressed—for which the workbench is of little or no help. For these instances a whole range of freestanding holding devices has been developed, including an astonishing variety of clamps (or cramps as they are known in Britain), and many other contraptions ranging from items big enough to grasp entire doors to tools small enough to grip the tiniest pin.

Wooden Clamps and Handscrews

The basic clamp, from which sash clamps, bar clamps and pipe clamps descended, developed from a simple device used in making handles (Figure 1). The earliest known examples of tool handle clamps are found in those parts of America settled by the Dutch, and the word itself derives from the Dutch *klamp*. In Britain, where there was little Dutch influence (and where tool handle clamps are almost unknown), the spelling has remained "cramp," reflecting its origin in the older German words *krampe* and *chrampf*.

***Graham Blackburn** builds furniture in Rio del Mar, California, and is the author of many woodworking books including* Floors, Walls and Ceilings.

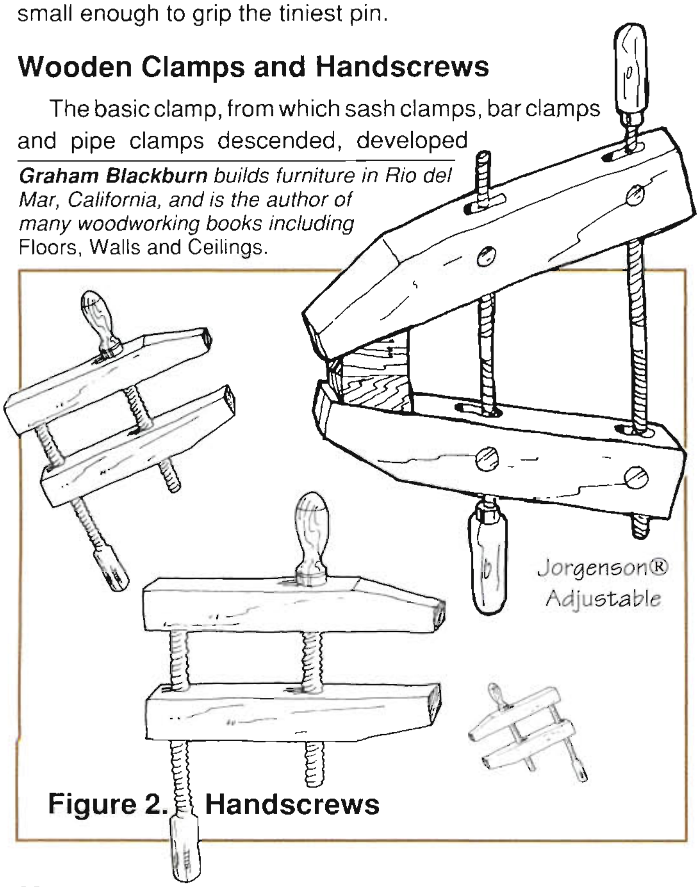


Figure 2. Handscrews

Designed to hold a piece of wood for working in the round with a drawknife, the tool handle clamp easily becomes a regular

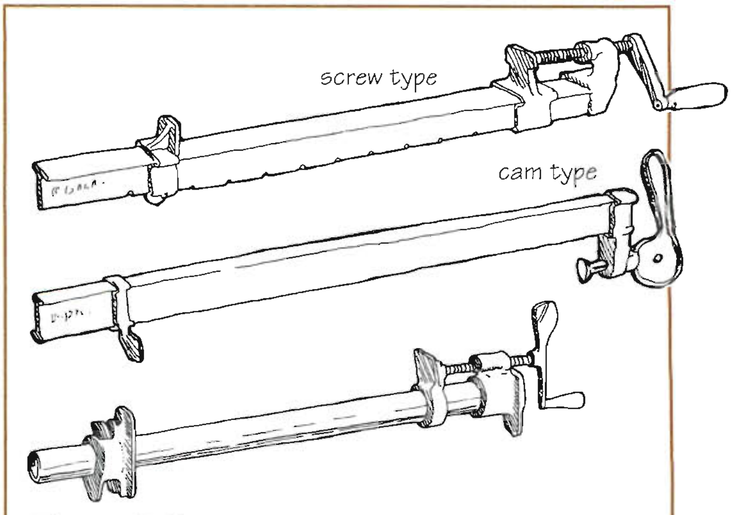


Figure 3. Bar and Pipe Clamps

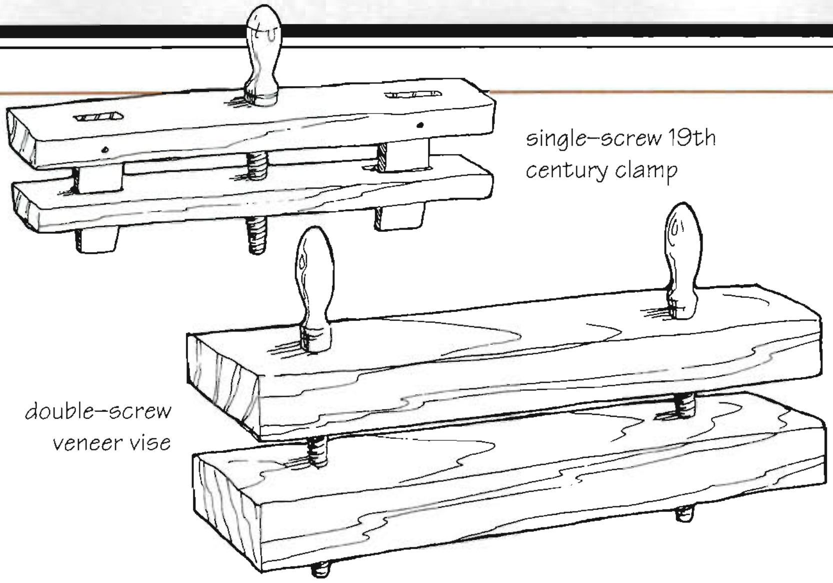


Figure 4. Specialized Clamps

illustrations by the author

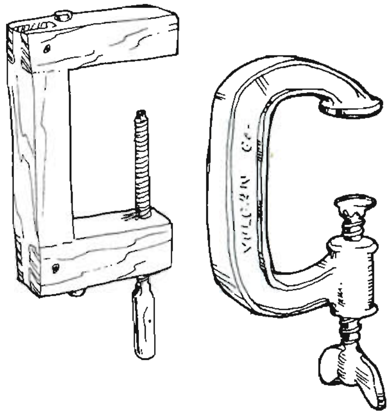


Figure 5. Wood Clamp and C–Clamp

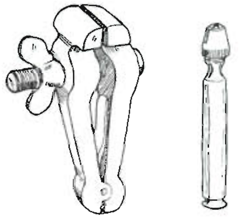


Figure 6. Hand Vise and Pin Vise

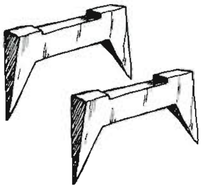


Figure 7. Joiner's Dogs

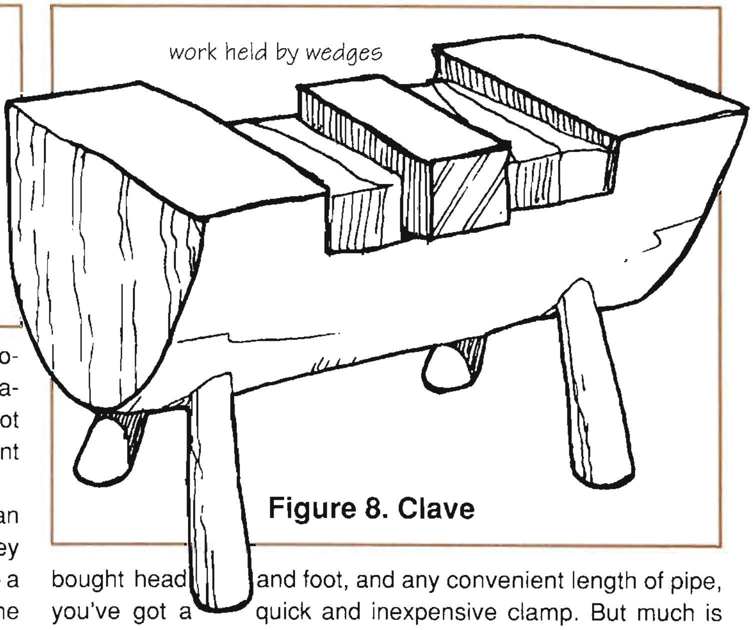


Figure 8. Clave

wooden clamp by making the fixed point movable to accommodate different length workpieces. There are innumerable variations on this simple theme—different ways to make the foot adjustable, different methods of attaching the screw, different ways of extending the stock or bar.

Handscrews are considerably more sophisticated and can cause problems for those unfamiliar with their working. They consist of two wooden screws inserted from opposite ends into a pair of wooden arms. One passes through a plain hole near the center of one arm and on through a tapped hole near the center of the other arm. The second screw is tapped through this arm but turns freely in a blind hole in the first arm. Both screws tighten the grip, but you must take care to turn them in unison or the arms will be forced out of parallel and soon bind.

Metal Bar Clamps & Adjustable Handscrews

If you have a screwbox (see Tried and True, *Popular Woodworking* #48) you can make these tools, but factory–made versions are now far commoner. Like their wooden counterparts, metal bar clamps have been made in a great variety of designs. Most of these—carpenters' clamps, builders' clamps, cabinetmakers' clamps, joiners' clamps, pianomakers' clamps, sash clamps, finishing clamps, and so on—merely reflect differences in size, length and sturdiness. The biggest difference comes with the newest variety—the pipe clamp. For the price of a separately bought head and foot, and any convenient length of pipe, you've got a quick and inexpensive clamp. But much is lost in rigidity and stability, and the remedy may require buying accessories, thereby offsetting the pipe clamp's main advantage.

The term adjustable handscrew refers usually to the type with metal screws that run through pivoting sleeves in the arms. The design was patented by Jorgenson® and they are often simply called Jorgensons (Figure 2). The pivoting screw allows the arms to tighten out of parallel, making their operation easier and permitting clamping of objects without parallel surfaces.

Specialized Clamps

Figure 4 shows a nineteenth century form using a single screw and two leaves which are fixed to the upper arm and ride through slots in the lower arm in order to keep the two arms parallel. This clamp is related to the more common double–screwed veneer vise. Another single–screw clamp, known simply as a wood clamp (Figure 5), is the forerunner of the now universal C–clamp,

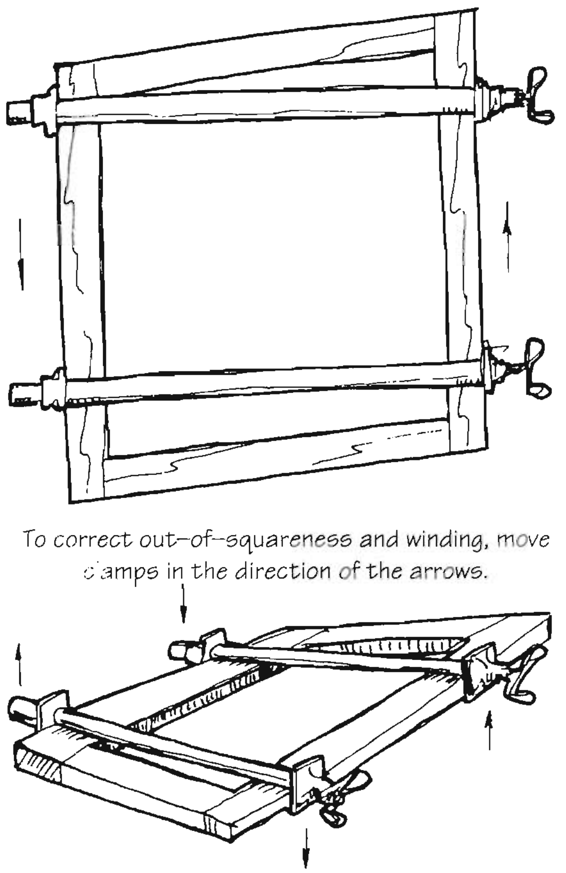

To correct out–of–squareness and winding, move clamps in the direction of the arrows.

Figure 9. Adjusting for Squareness

which is known as a G–clamp in Britain. Like bar clamps, C–clamps can be screwed or cam–operated and come in a huge range of sizes, from tiny 1" models to giant versions used in industries beyond woodworking.

Saw vises, both the wooden kind designed to be held in a bench vise as well as the adjustable metal kind, are well known types of clamp. Hand vises and pin vises (Figure 6) are found in great variety and often the subject of large collections.

The joiner's dog, 2" to 4" long (Figure 7), is handy for driving into the ends of boards to keep them together while gluing. The wedge shape of the points pulls the boards closer the further you drive them in. The joiners' dog is closely related to all sorts of other woodworking dogs such as cant dogs, hewing dogs, ring dogs, and strake dogs, all of which are much larger and used simply for holding large pieces like logs or parts of wheels.

The clave (Figure 8) is basically a receptacle in which the workpiece is wedged; it can be adapted for almost any size object—even the floor can become a clave. Instrument makers have developed specialized clamps that can be useful in a general shop. Violin clamps are the best known and simplest, *consisting of* nothing more than a threaded rod with round blocks at each end, one being fixed and the other adjustable.

Perhaps the largest holding devices are those used as veneer presses, often capable of holding 4' by 8' sheets, but smaller, more convenient versions can easily be made for the home shop. Equally useful are benches or tables set up to contain a series of pipe or bar clamps recessed in the top surface so that large panels, doors, frames and even carcases can be clamped up.

Clamping Techniques

The prime rule when using any clamp is to ensure that it doesn't mar the workpiece. Plastic pads are available that slip over the jaws of pipe clamp fittings, but keep blocks of soft wood on hand for other unprotected metal (and even wooden) shoes and jaws. The second rule is to avoid over–clamping and unequal clamping. Ideally, surfaces to be joined should mate perfectly without being forced into position by the use of clamps, and severe pressure is seldom needed for a good glue bond. When the surfaces mate well, excessive pressure merely squeezes out the glue and "starves" the joint. If the joint is poorly prepared and you need extreme pressure to bring the surfaces together, both misalignment and starved joints are likely.

When the joint is well prepared, misalignment can occur if clamps are poorly positioned. Always test for squareness and winding when clamping up framework, and adjust the clamps as shown in Figure 9 if necessary. Clamps can be heavy, and their weight alone can have an effect on the workpiece; what looks square clamped up may not be when you remove the clamps.

For extra length, you can bolt bar clamps together with their feet removed—both ends of the unified clamp now being adjustable. And you can hook the feet of pipe clamps over one another if a longer length of pipe is not handy. For very long pipe, you'll need support in the middle of the length, but take care that the support does not act as a fulcrum and press the work out of shape.

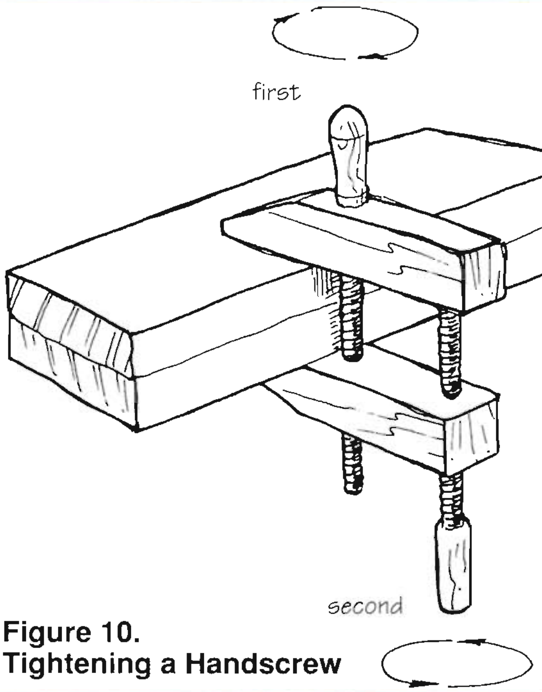


Figure 10.
Tightening a Handscrew

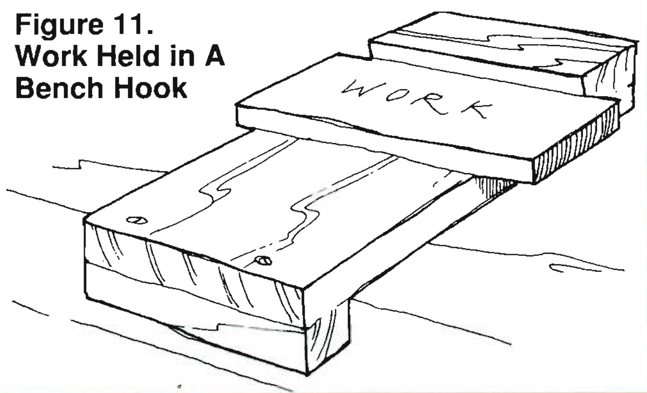


Figure 11. Work Held in A Bench Hook

Illustrations by the author

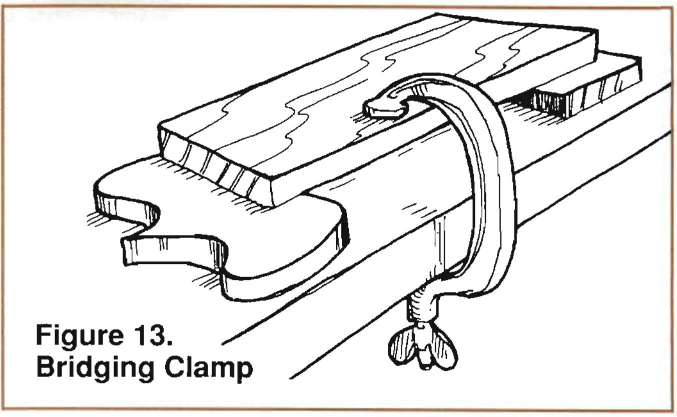


Figure 13. Bridging Clamp

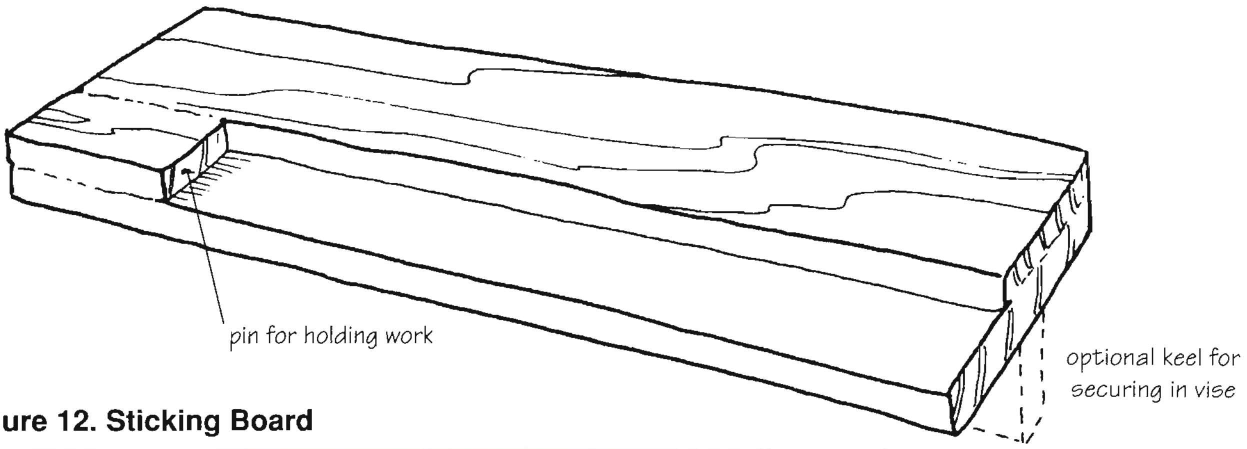


Figure 12. Sticking Board

Wooden handscrews are quickly adjusted as follows. First, making sure that the jaws are parallel, grasp a handle in each hand and revolve one around the other. The jaws will remain parallel whether you're opening or closing them. When the opening is close to what you need, position the handscrew on the work and tighten the jaws by turning the inner screw first, followed by a turn of the outer screw as shown in Figure 10. This last turn levers the jaw over and onto the wood, and should only be very slight. If you need to turn it more, you should first make the jaws more nearly parallel and closer onto the work. Maintaining as much parallelism as possible is the goal. Jorgenson® handscrews relieve you of this burden, but be aware that unevenly adjusted jaws will have the same misaligning effect as unevenly applied bar clamps—an effect that may sometimes, however, be needed and used to advantage.

Keep all wooden jaws on any clamps planed smooth and clean. A light coat of wax will help prevent glue adhesion, but it will also increase the likelihood of unparallel jaws slipping off the workpiece when tightened. It's therefore a good inhibitor of careless and excessive clamping.

Simple Holding Devices

Apart from the many holding devices common to most modern benches—such as catch pins, movable bench dogs, holdfasts, deadmen, and a variety of attached vises—there are items that while separate nevertheless function with the bench as an indispensable partner. The simplest and perhaps oldest is the bench hook or side rest (see Figure 11), used for providing a support for work being sawn on the bench.

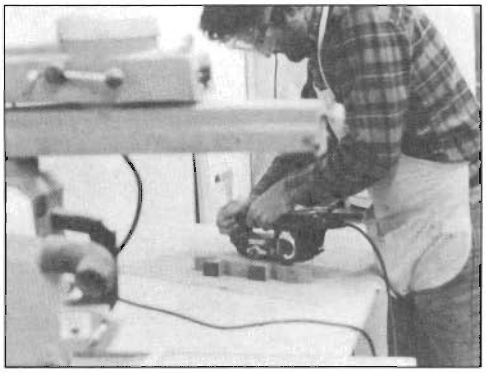
There is a whole class of holding devices with purpose–shaped jaws designed to match what needs to be held, and which in turn are designed to be held either in a bench vise or in another clamp, which itself may be held in a bench vise.

Sticking boards (Figure 12) may also be purpose–made and are the traditional method of securing work that is too small to be held in any other way. The board may be built up or rabbeted, and it may be held on the bench by a holdfast, between dogs, or in the vise by means of a keel attached to its underside. It may even be made adjustable with the addition of a *sliding fence. Bridge clamping* is another useful technique for awkwardly shaped pieces that can't be held any other way. The idea is to clamp a stout bridge piece that connects the work and an equally thick auxiliary piece (Figure 13).

Clamping picture frames is a branch of woodworking that has developed virtually its own tool kit, but every woodworker ought to be familiar with the various proprietary corner clamps available, as well as factory–made and user–made belt, strap, and rope clamps that work with ratchets or simple tourniquets. Finally, don't forget that wedges may be used to hold many things, from tiny pieces on the bench to large objects like doors. PW

Project for the Shop

Dust Bench



by B. William Bigelow

Woodworking may be much more hazardous to health today than it was in grandfather's time. High speed saws, routers and sanders have increased our exposure to dust and noise to the extent that we should consciously take more precautions than grandpa did.

Earlier woodworkers surfaced stock with hand planes and fashioned mouldings with specialty planes and scrapers. Cutting was done largely by hand, and smoothing was accomplished with broken glass, planes and scrapers. Today we surface with motor–driven planers and jointers. High speed saws and routers are the mainstay of our cutting tools. Nowadays we employ sanders whirring at 12,000 rpms for smoothing operations much more frequently than scrapers and hand planes.

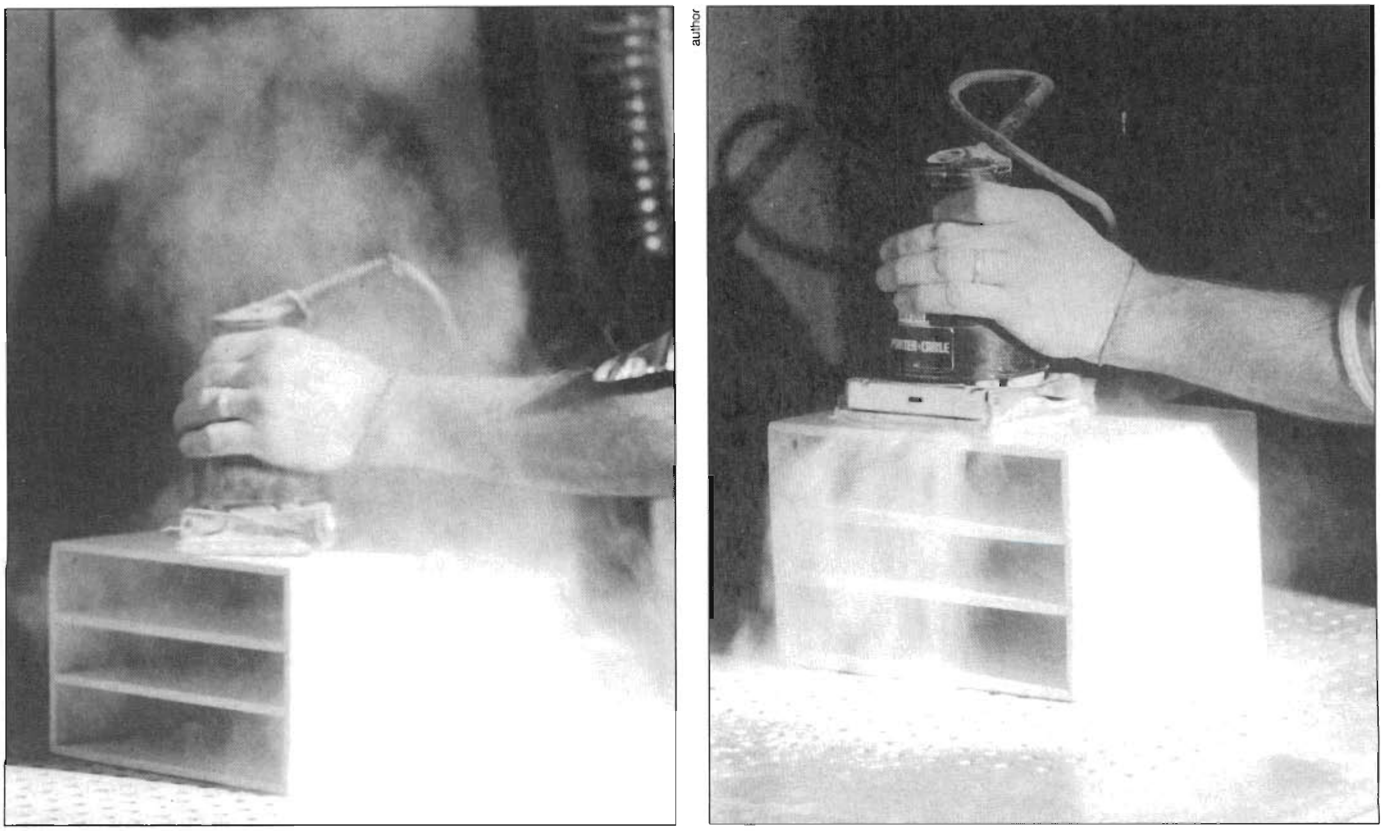
Hand methods are slower, but they're also quieter and cleaner. The waste chips are large and contribute little to the airborne particles circulating in our shops. Powered woodworking is faster, sometimes more accurate, but definitely noisier and dustier. We should be concerned about irritating airborne dust. High speed cutting edges make smaller chips, and the dust is flung into the air by the circular motion of the cutting edge and the machine motor's cooling fan. Without dust removal or respiratory protection, you're breathing directly from the dust cloud. Experts can tell us exactly how harmful that is, but common sense should be enough to warn us that breathing that dust is irritating and eventually unhealthy.

We can take steps to lower the hazard. When skill and time permit, choose hand tools instead of power tools. Many woodworkers "rediscover" the high quality and efficiency of hand tools after using powered equipment for a few years. But most of us like and need our power tools, and don't plan to give them up. We can develop dust removal systems for our shop that will cut down the

---

***B. William Bigelow** teaches woodshop in the Industrial Arts Department at Contoocook Valley Regional High School in Peterborough, New Hampshire.*

The top photo shows the dust bench adapted to a radial arm saw outfeed table. Below, you can see the difference between sanding with and sanding without the dust bench. Note how dust is pulled toward the bench top when the system is on, but rises in a cloud when it's off.



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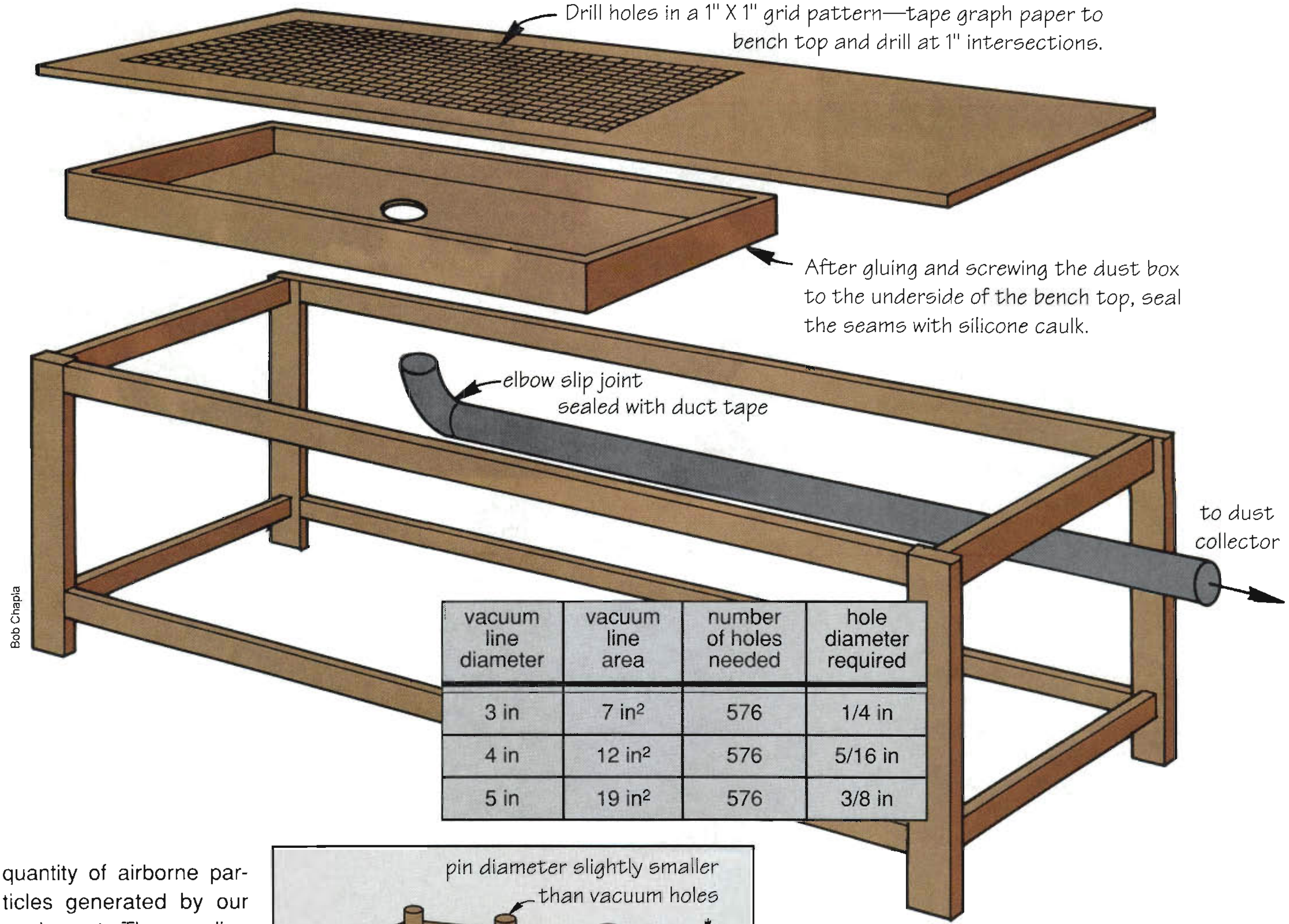
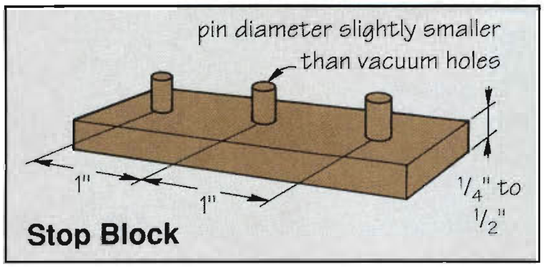

Drill holes in a 1" X 1" grid pattern—tape graph paper to bench top and drill at 1" intersections.
After gluing and screwing the dust box to the underside of the bench top, seal the seams with silicone caulk.
elbow slip joint sealed with duct tape
to dust collector

Bob Chapla

vacuum line diameter	vacuum line area	number of holes needed	hole diameter required
3 in	7 in^2	576	1/4 in
4 in	12 in^2	576	5/16 in
5 in	19 in^2	576	3/8 in



quantity of airborne particles generated by our equipment. The sanding workbench pictured here is one example. It's easy to install and although it won't come close to sucking up every particle your sander spits out, it will reduce wood dust in the air. You can easily modify the design for your particular need or adapt it to an existing bench as we did here. I installed the sanding bench in the corner of my shop last year and immediately noticed a fairly substantial decrease in housekeeping chores. Dust doesn't settle over the shop as it used to.

The sanding bench works best when connected to an in–shop dust collection system capable of 450 cubic feet per minute or more. Shop vacuums are less desirable because they generate relatively low volumes of air, and their brush motors emit high noise and have short lifespans. The induction motors of the larger units generate high volume, last a long time, and run much more quietly.

The basic design consists of a benchtop with a dust manifold attached to its underside. Air is drawn down through $^1/_4$" holes in the tabletop. Thus dusty air from the sanding operation is forced down to the table by clean air moving from the room past the operator toward the holes. The manifold is attached to a box frame which you install on the underside of your sanding bench.

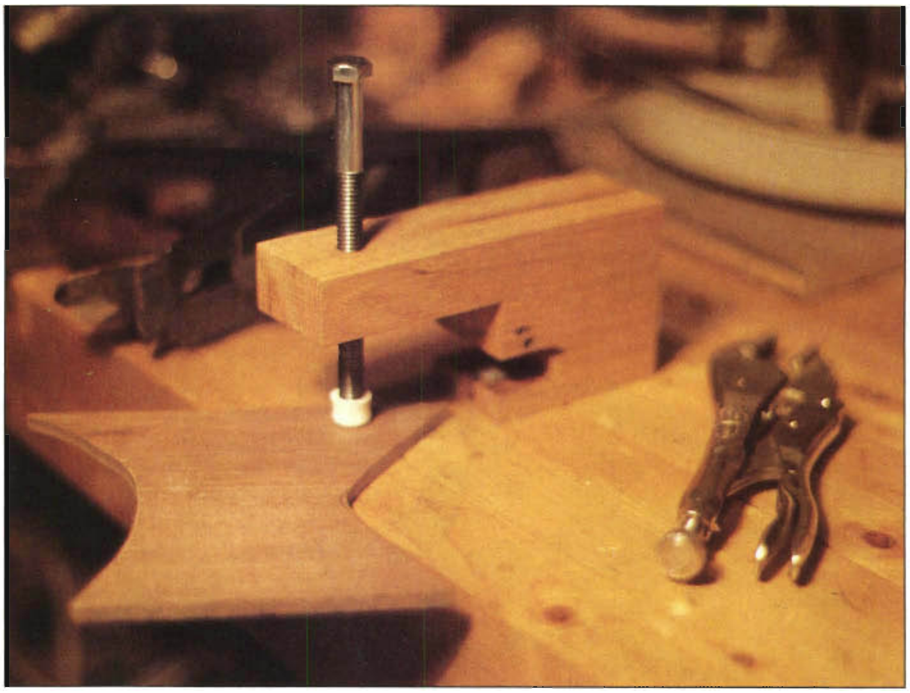
Drill the holes in the top before attaching the box. One way to do this is by taping graph paper to the top and drilling right through it. The chart above suggests the right number of holes for air pipes of different sizes. Often the stock I'm sanding will generate enough dust to start blocking many of the holes. I compensated by drilling about 50% more holes than the chart suggests and, when sanding small projects, simply covering some of the holes with a sheet of paper.

The box should be carefully made and the seams caulked to keep the box as airtight as possible. Cut a hole in the bottom panel of the box to receive the adaptor which will connect the box to the dust pipe. I use a recycled rectangular–to–round hot air vent in mine. Since you may need to clean inside the box from time to time, you can hinge the top at the back or make it completely removable—held by strips screwed to the bench frame.

Any number of custom adaptations are possible. A stop block will hold stock on the table when belt sanding. I drilled an oversize hole in two end legs for a sturdy dowel to hold rolls of sandpaper. Add a shelf or cabinet below to store sanding tools and equipment. You might want to size the dust box to cover only half the bench top, leaving room at one end to secure a router underneath. The sanding table will keep the area cleaner and help reduce a potentially serious health hazard. PW

Project for the Shop

Benchtop Clamp



by *Dana Martin Batory*

How would you like a benchtop clamp that is cheap, removable and strong enough to do the job? This shop–made device works like a workbench holdfast. I made it in about an hour, from a red oak 2 X 4 salvaged from a discarded pallet and about 50 cents worth of hardware.

The base of the wooden jig is slotted to slide beneath the head of a carriage bolt that is installed through a hole in the workbench top and fastened below with a nut and jam nut. When not in use, you just slide the clamp off and the bolt drops snugly into its countersunk nest.

Lay out the clamp's shape on the block as shown in the illustration. I prefer to do as many operations as possible before cutting to final shape. First, on center, 1" in from the clamp's nose, drill a $^{1}/_{8}$" pilot hole 1$^{1}/_{4}$" deep. Turn the block over and drill a series of overlapping $^{3}/_{8}$" holes $^{5}/_{8}$" deep for the carriage bolt throat. Use a chisel to square up the edges of this slot.

Now set up your table saw so the blade cuts at a depth of 2" and make the vertical cut for the clamp opening. Use a band saw for the horizontal cut. Make the slot for the bolt head by making a series of closely spaced band saw cuts and then cleaning out the waste with a chisel.

Using the pilot hole you drilled earlier, countersink a recess for the T–nut flange with a 1" spade bit. Then follow that with a $^{1}/_{2}$" bit to make a cavity for the T–nut column. Use a $^{3}/_{8}$" bit to make the hole for the bolt. Back up the material with a block of wood to prevent splintering upon break-through.

You'll need to extend the threads of a hex head bolt by about 2$^{1}/_{2}$", or you could

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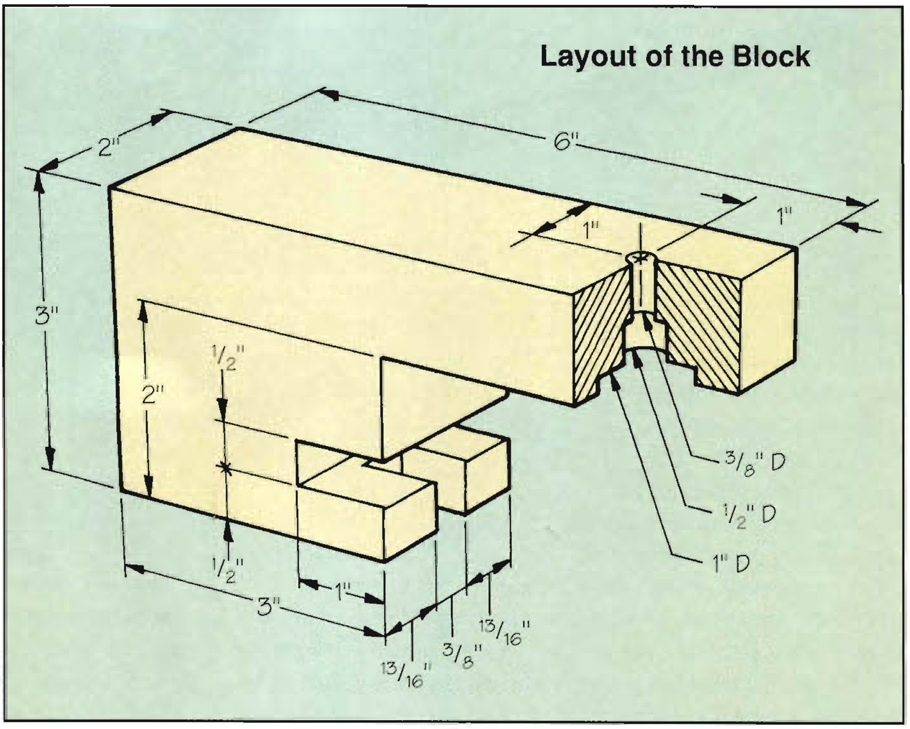
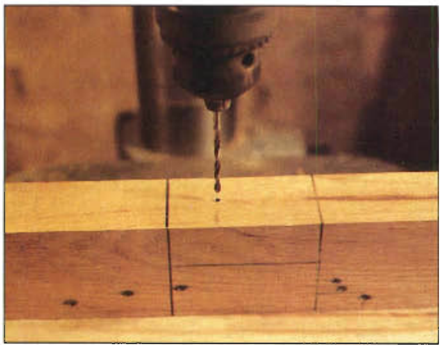
***Dana Martin Batory** is a writer and cabinet-maker who is particularly fascinated with reproducing Shaker furniture at one–twelfth scale. He also collects and restores antique woodworking equipment and is a founding member of the American Antique Power Tool Association.*

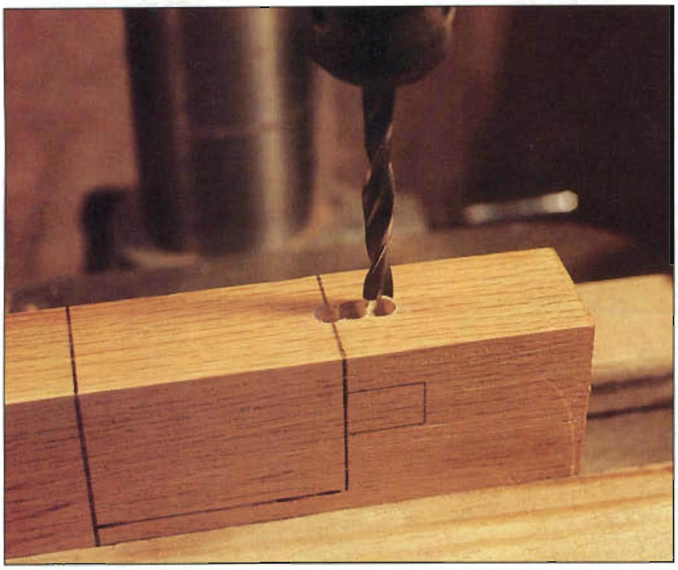


Tom Larson

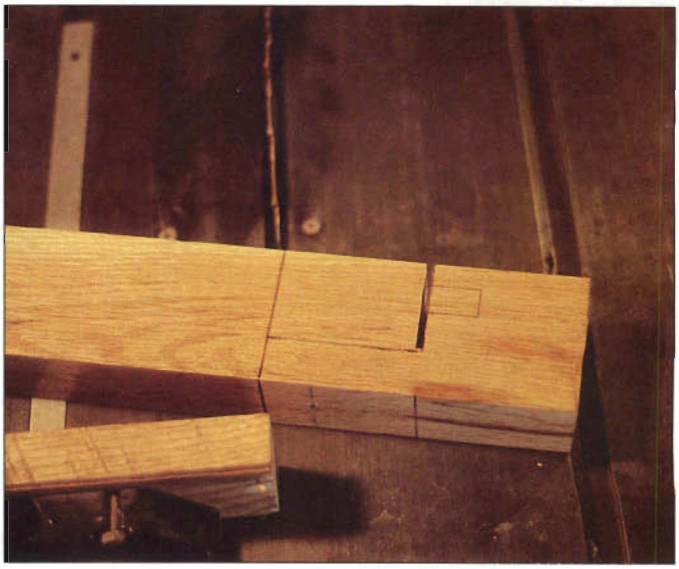
After laying out the shape on the block, drill a pilot hole 1" in from the end on center.



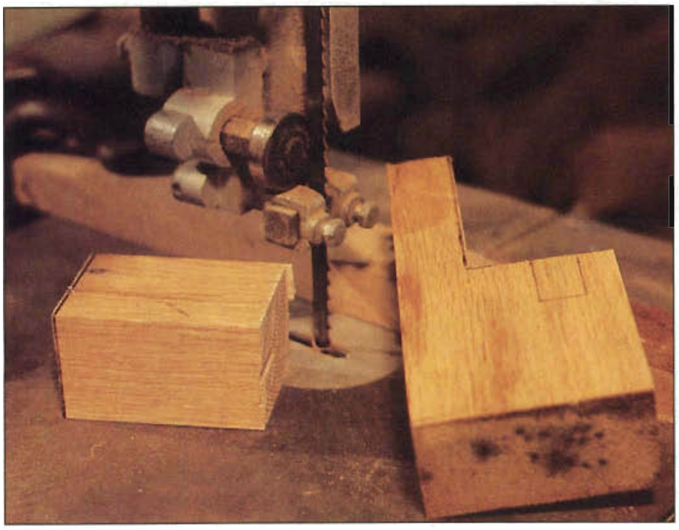
Benchtop Clamp	
Qty	**Materials**
1	hardwood block 2" X 3" X 6"+
1	$^{3}/_{8}$ X 4$^{1}/_{2}$" carriage bolt
1	$^{3}/_{8}$" ID washer
2	$^{3}/_{8}$" nuts
1	$^{3}/_{8}$" X 5" hex head bolt
1	$^{3}/_{8}$" T–nut
1	doorstop bumper tip



On the underside, drill a series of $^3/_8$" holes $^5/_8$" deep to form the carriage bolt throat. A carriage bolt head slides in here to secure the block to the benchtop.

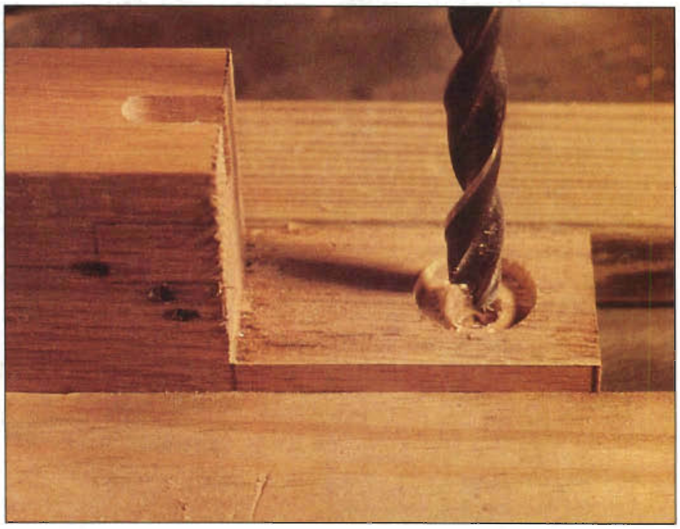


Set the saw blade to cut 2" deep and make the vertical cut that establishes the mouth of the block; then lay the block down and cut it to length.



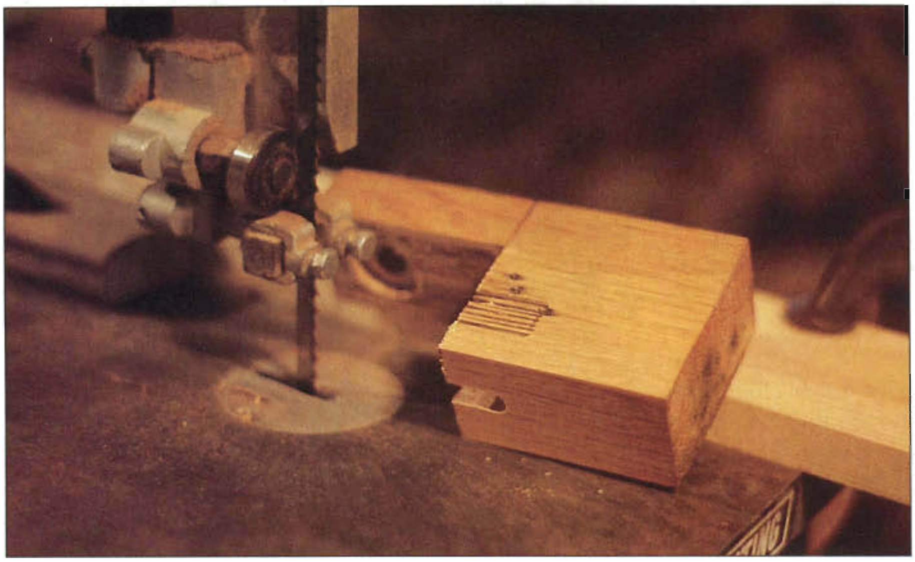
photos by the author

Use the band saw to make the rip cut that removes the rest of the waste from the mouth.



Use the pilot hole drilled earlier to guide the drills for boring the 1" recess and then the $^1/_2$" shaft hole for the T–nut. Then drill a $^3/_8$" hole the rest of the way through for the bolt.

Make several band saw kerfs and then use a chisel to clean out the bolt head slot.



use a length of $^3/_8$" threaded rod with a shop–made handle. I use an old $^9/_{16}$" wrench or a pair of locking pliers to run the bolt.

Sand and varnish the clamp three times, steel wooling between coats. Finish off with a coat of paste wax. Drive the T–nut into place and draw it down until it is flush with the clamp face. Thread the bolt through and slip on the rubber tip from a doorstop.

Position the clamp where you'll usually want it on the workbench. Drill a $^3/_8$" hole in the benchtop, and countersink so the carriage bolt head falls flush below the surface. Slip the clamp slot beneath the carriage bolt head, and set the jam nuts and washer on the underside of the bench so they hold the clamp securely. PW

Sailor's Work

by Beverly Newton

When Helmer Hanson was growing up, there was a picture hanging in his parent's home that fascinated him. The artwork wasn't what captured his attention; it was the frame. It was a series of thin slats of wood, hand–whittled and "knotted" together by his uncle, a fisherman. It was common for fishermen in Norway to take handiwork with them to sea. When they were becalmed they would take out their work. Some knitted, some crocheted and some whittled.

Young Helmer studied that old frame for a long time, then decided to try "sailor's work" himself. Eventually, he succeeded in carving a frame very similar to the one his uncle had made with a pocket knife.

Over the years Hanson has searched for other examples of sailor's work or "Crown of Thorns" as it is also called. He and his wife have found examples in museums in Oslo, Norway, Nova Scotia, Canada, and, oddly enough, in a saloon in Nevada called the Bucket of Blood.

"In each case," Hanson says, "the piece was in such bad shape it was about to fall apart. Green wood had been used and when the wood dried out it came loose. My pieces will be as strong and solid fifty years from the time they were finished as they were the day they were done because I use only seasoned wood."

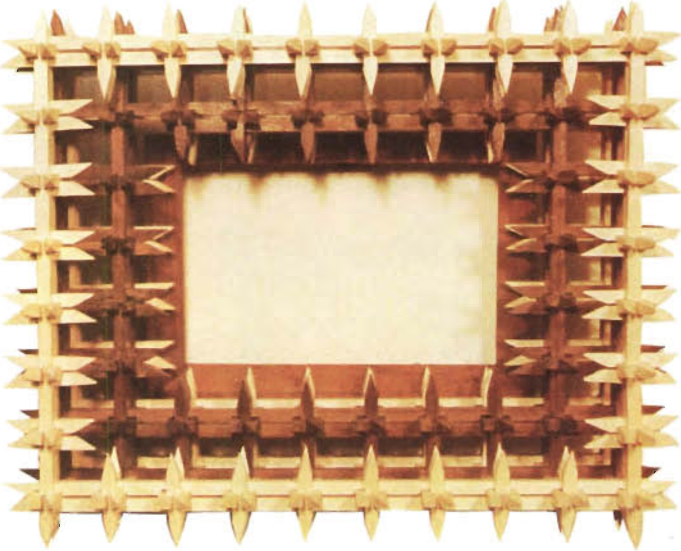
Hanson comes from a long line of woodworking craftsmen. During the depression of the 1930's his father and brother turned to making fine furniture to support themselves. The Hanson home is dotted with their work, but Helmer didn't follow his father and brother into woodworking. He became a pharmacist, and after that first frame, did no more work on his craft till 1952.

***Beverly Newton** is a freelance writer in Niwot, Colorado.*

Making A Sailor's Work Picture Frame

by Helmer Hanson

All sailor's work is based on assembling different lengths of similarly notched material. I start by ripping strips of wood to a basic thickness and width. I then notch them at regular intervals using a miter gauge jig similar to that for making finger joints. Different constructions, whether clocks, picture frames or what have you are built by making different arrangements of these basic pieces.



Making the Basic Pieces

The dimensions of the strips and notches are indicated in thousandths of an inch because I have found that this unit of measure expresses the proportions I like best, to the degree of accuracy I *need. I* check my dimensions with a dial micrometer.

Any kind of wood can be used, pine, mahogany; I made the frame shown here out of black walnut and basswood. The harder

Extremely clever with his hands and his engineering brain, he has five patents to his credit. The first three were for a trading stamp dispensing machine, and in the sixties, he invented something called a Cycle–Selector used in developing color film.

Precision is the criteria for all Hanson's machines. This same precision is the most necessary ingredient in sailor's work.

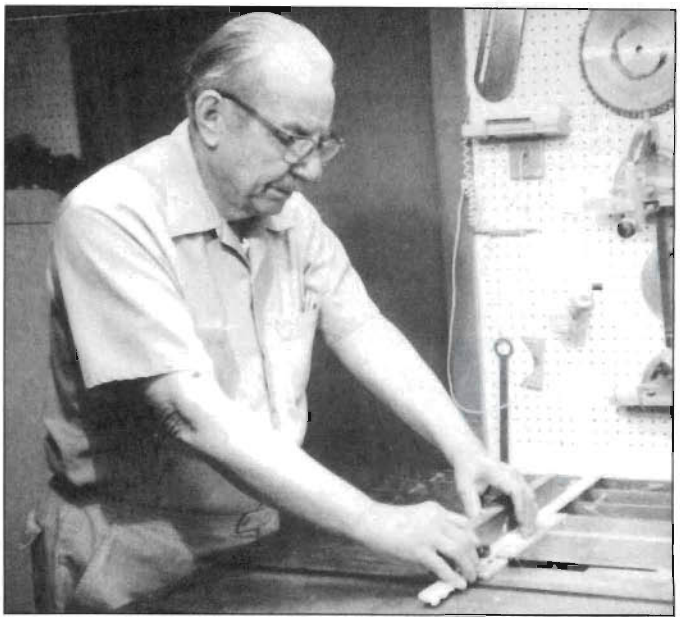
He buys one or two inch planks and rips them into one–fifth inch strips. "If the strips are much wider than this, the work looks coarse and crude." He uses a dial micrometer to insure consistency.

After the strips are ripped, he notches the pieces. "I had to make jigs to control accuracy (for the width and depth of notches)," he said. "Anyone who wants to do this work must keep dimensions to a reasonable tolerance." Next he cuts the strips into the length he needs and then he makes the points on a belt sander.

The final step is assembling the pieces. A large clock will take him a month of "good solid work." Clocks are his favorite item to make, but he has made picture frames and a large creche. On his clocks he makes his own dials, using a hot stamping machine to mark the numerals. The finished clocks are coated wtih clear Krylon® because it keeps the dust from permeating the wood.

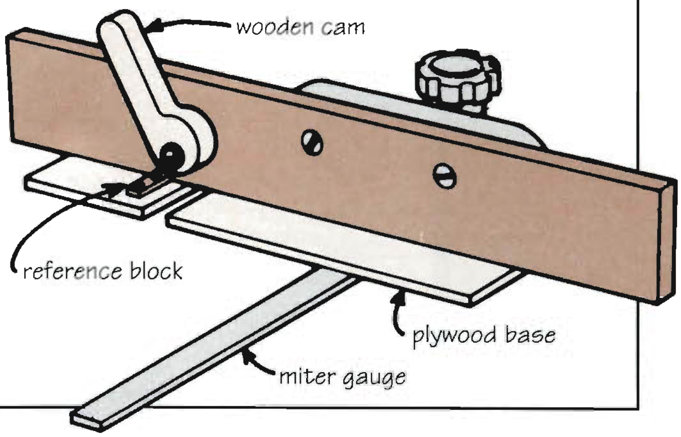
To find out about the history of sailor's work, Hanson has done some real sleuthing. He found a reference to it in a book by Helaine Fendelman called *Tramp Art.* Fendelman said tramps who walked the United States during the 1800's used to make similar pieces to trade for meals. Hanson doubts this because of the precision demanded. "By the time a tramp had finished one piece he would have starved to death."

Hanson continues to practice this old craft. He encourages people to contact him to share information, and he's willing to teach the skill. On the following pages he provides instructions for making a simple picture frame. PW



Helmer notches several pieces at once using a miter gauge jig similar to those used for making finger joints or dentil moulding. A cam lever on the jig assures that the pieces will be cut to the right depth.

Figure 1. The Notching Jig



the wood the tougher it is to assemble the "knots." Basswood is my favorite because it has compressibility and flexibility. You will get a tighter frame if your wood is as dry as possible.

I use a sharp blade to rip the strips to .200 thousandths of an inch square in cross–section. Use a push stick to hold the wood firmly against the fence. *[**Editor's note:** for a good safe method of ripping thin stock see PW #58 p. 69.]*

My notching jig consists of a wooden fence that is attached to a narrow plywood platform on which the material rides (see Figure 1). I've attached a reference block that is .100" thick and .450" wide to the platform. It's spaced .520" away from where the edge of my dado blade will cut. Also attached to the fence is a pivoting piece that acts like a cam clamp; it's positioned right over the referencing block, helping to assure the notches are precisely cut to depth. The notches must be of uniform depth, width and distance apart or there will be trouble. The knots will either be loose and sloppy, or if too tight, they will break the wood. The ideal measurements are shown in Figure 2.

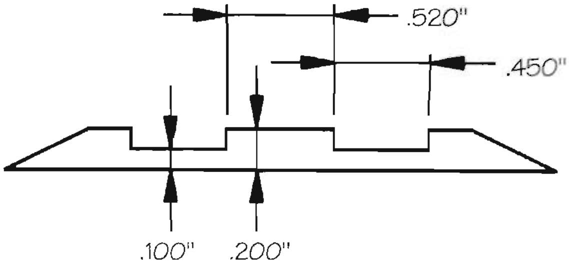
I use an adjustable (wobble) dado set to the width of .450" and a depth of .100". I cut a notch, reference that notch on the little block and cut the next one, repeating this for the length of the strips. The width of the clamp block and the platform allow me to notch several strips at once.

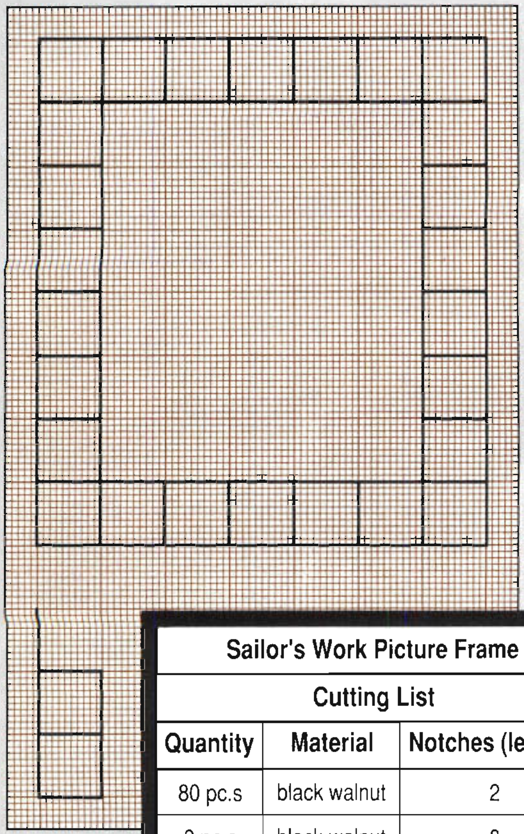
Sizing the Pieces

I always make a skeleton layout of what I plan to make on some graph paper. I decide on the outside dimensions in even inches; then I determine how many square knots wide and how many

Illustrations by Tom Larson

Figure 2. The Basic Dimensions





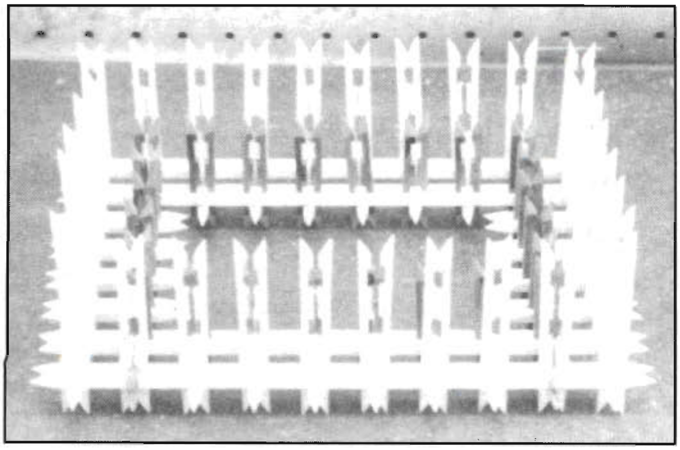
Sailor's Work Picture Frame

Cutting List

Quantity	Material	Notches (length)
80 pc.s	black walnut	2
8 pc.s	black walnut	8
8 pc.s	black walnut	10
56 pc.s	basswood	1
40 pc.s	basswood	2
64 pc.s	basswood	3
12 pc.s	basswood	8
12 pc.s	basswood	10

Figure 3. The Knot Layout

At this stage (below) the back layer is assembled and all the pieces that establish the depth of the frame are in place. Helmer uses a homemade wrench (right) to twist the sixth piece of every knot assembly into place.



square knots deep the project will be. A square inch on the graph paper indicates a square knot. Where the lines intersect indicates the centers of notches. Think of your project's dimensions in terms of the number of notches in each piece. Figure 3 shows the layout for this picture frame; the chart in Figure 3 shows the quantities and lengths you'll need. Cut the pieces to approximately $^3/_4$" past their last notches.

When I made my first frame I whittled the ends to a point; once is enough of that. There is enough work involved in making the pieces that it behooves one to take advantage of every labor–saving device available. I have a jig that attaches to the table of my stationery belt sander. Three little fences are attached to the plywood base at different angles. These reference the three surfaces of each piece that get tapered to a point.

The final operation before assembling these pieces is to cut small relief notches in the locking pieces—the last piece in each knot. If we were using green wood, these relief notches would not be necessary. But because dry wood is not as flexible, the relief notches make it easier to twist the pieces into place. I cut the relief notches in the center of each notch and up one side using a $^5/_{32}$" flat–bottom bit in my router table.

Assembly

Each knot involves six pieces and each piece is usually involved in several knots. As you construct your project, you are working from front to back, side to side and top to bottom simultaneously.

Figure 4 shows the step–by–step assembly of a basic knot. All notches face toward the center of the knot. Pinch piece A between the notches of two matching pieces, B and C (Step 1). Fit piece D into the notch of piece A, with its notch capturing B and C (Step 2). Do the same with piece E; then slip piece F in between the points of B and C and twist it into place to lock the knot (Step 3).

Assemble the frame starting with one of the bottom back corner knots. Choose the six pieces that are appropriate for that point, based on the layout diagram (Figure 3). When that knot is locked together, proceed along the bottom of the frame installing

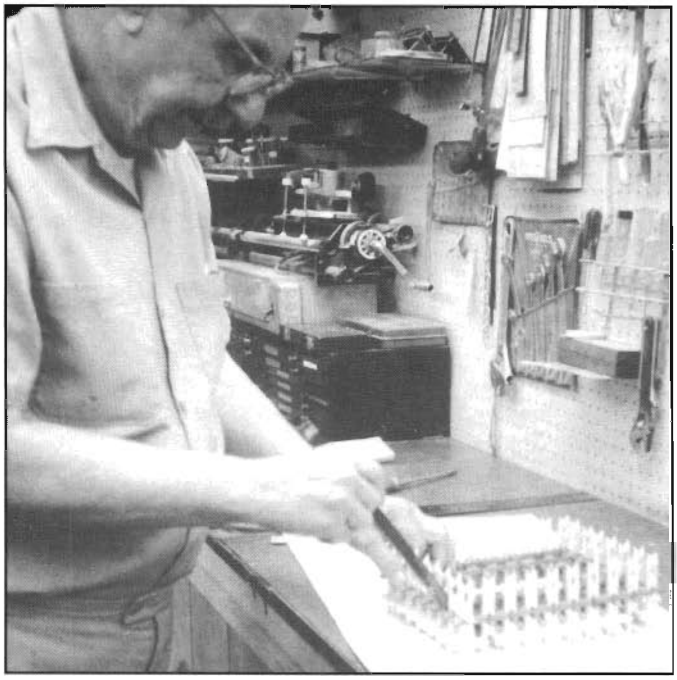
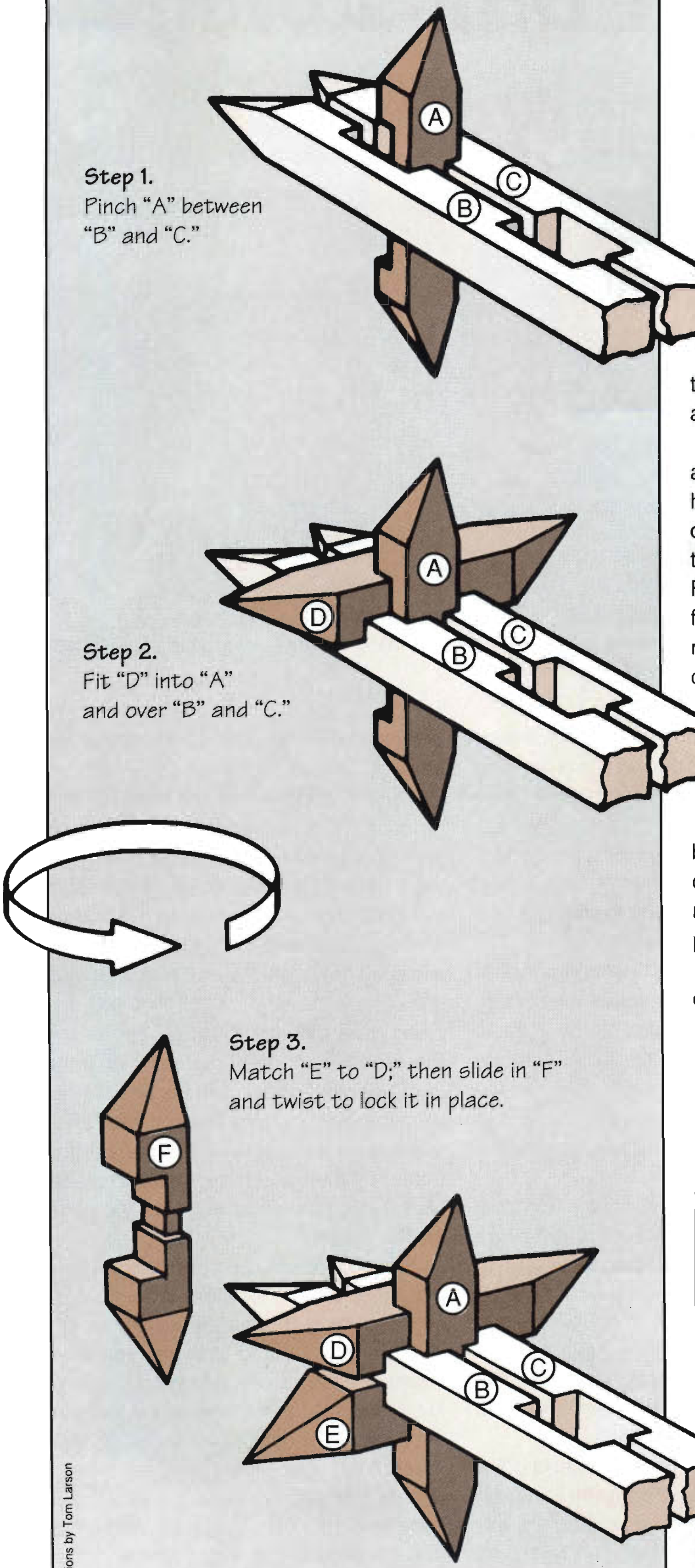


Figure 4. Assembling a Knot



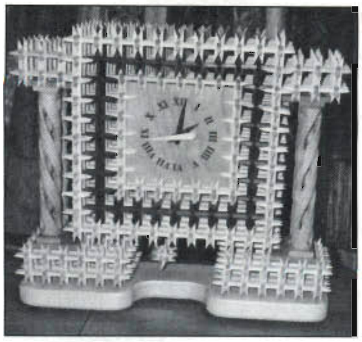
Step 1.
Pinch "A" between "B" and "C."

Step 2.
Fit "D" into "A" and over "B" and "C."

Step 3.
Match "E" to "D;" then slide in "F" and twist to lock it in place.

illustrations by Tom Larson

Columns, clock faces and other decorative elements are simply sized to fit between the layers.



back members and three–notch members. Put together all the knots that comprise the back plane; then add layers on top of this assembly. Each layer starts with one cross piece, then the vertical pairs, then the other cross piece is pushed and twisted into place. I use a piece of flat metal stock to help push the pieces in evenly, and a homemade wrench (square stock with a notch that fits over the pieces) to twist and lock them.

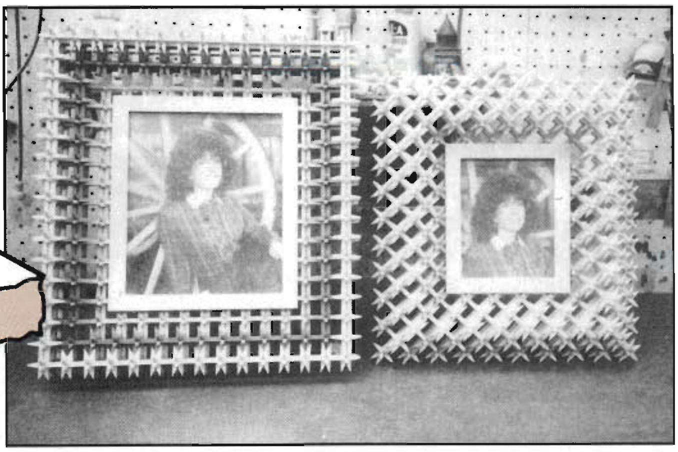
It's easy to incorporate other elements into sailor's work assemblies; you just size them to fit between layers. The knots all have 1" centers and the spaces between them are $^3/_4$" in one direction and $^1/_2$" in the other. Count the number of knots between the two points and add $^3/_4$" or $^1/_2$" depending on the orientation. For the project at hand, I made a mitered wooden frame with finished dimensions of 4$^3/_4$" x 6$^1/_2$" (four notches plus $^3/_4$" by six notches plus $^1/_2$"). If this were a clock face or a column, I'd just capture it between layers during assembly. I'd trim the ends of the pieces that butt against the base of a column square, and size the column to fit between them. For the frame we're building, I glued my mitered wooden frame between the tips of the pieces projecting out the back of the assembly.

The photo below shows a diagonal orientation of the same basic pieces. You lay this out on 1" graph paper, just like the other one, and figure out how many pieces you'll need and how many notches per piece. Then you just start stacking them and snapping them together. PW

Readers can feel free to call or write to me to get help or discuss the craft.

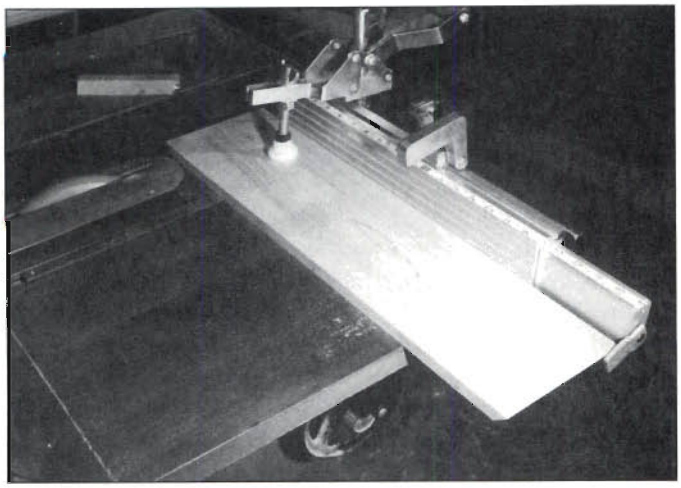
Helmer C. Hanson
3422 Dover Rd.
Cheyenne, WY 82001

You can make different frame styles using the same basic technique. To make the frame on the right, lay it out on graph paper with the grid oriented diagonally.

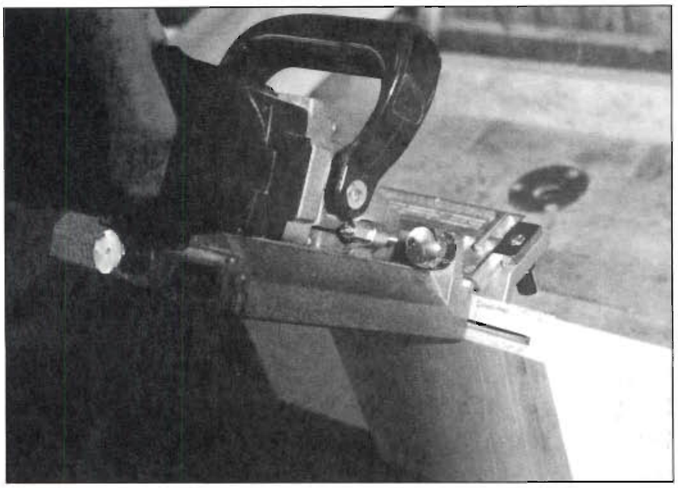


A Popular Woodworking Project

Building Compact Disk Storage Using Biscuit Joinery



Accurately cut miters are crucial to a well–joined case. Use a stop with your miter gauge to make sure that identical pieces are cut to the same length.



Since the stock is only $^5/_8$" thick, set the joiner to cut slots for #0 (the smallest) biscuits.

by Hugh Foster

I'm a music lover, so I buy records—CD's now. "Too darn many of 'em," my wife says. The first few just hung around the hi–fi in neat little stacks, but then... As the disks and their "jewel cases" proliferated, keeping peace in the family required that I find a place to store them. (Besides, I didn't want the stack to look as if it were growing too fast.)

Browsing through the music magazines, I found that most often the elegant solutions were extraordinarily simple and almost always made of luxurious materials. I designed my own simple shelf that holds just over 100 disks, and is an incredibly easy exercise in biscuit joinery. (If you don't yet have this technology, you can join the corners with splines, dovetails, or rabbets; you'll just need to adjust the dimensions appropriately.)

The biscuit joiner makes it easy to make boxes and other carcase projects with mitered instead of butted corners. Without biscuit joinery, carcase miters are almost impossible to join, and a simple project like this can take a good deal longer than the two hours I spent building and finishing this one from rough–sawn boards.

All the pieces are $^5/_8$" thick hardwood, except the back which is $^1/_4$" hardwood plywood. You can go with the dimensions in the cutting list, or adapt the unit to your own needs by keeping the dimensions of the CD's "jewel box" in mind; the singles are $^3/_8$" thick and doubles are $^{15}/_{16}$" thick. It's best to cut the $^1/_4$" X $^1/_4$" rabbet along the back edges of the top and bottom (A) and the ends (B) before you cut them to length and miter their ends (see Figure 1).

Cutting the miters is tricky. It is important that the pieces correspond to one another accurately if the joints are to work, so you need to clamp a stop to an extension on your miter gauge to hold the stock securely. I have a miter gauge that has a built–in stop, but you should be able to come up with a similar setup using scrap wood.

Cutting the slots for the joints is done by simply centering the biscuit joiner on the miter face. If you aren't absolutely certain of your machine, you might do well to make test cuts on mitered scrap stock. Since this is thin stock, use the #0 setting on the machine to cut slots for the smallest biscuit.

Cutting the joints for the shelf (C) and partition (D) is really easy. When biscuit joining, measure to an edge of any divider, rather than the center. In this case, the shelf edge will be 5" from the bottom and 5" from the top (see Figure 2). Lay the shelf down on the end piece, line up the end of the shelf with the mark and clamp it in place. With the base of the machine flat on the end piece, make the plunge cut into the end of the shelf. Then turn the machine around and reference the base against the end of the shelf to make the plunge cut into the end piece. Use the same procedure to cut the joints for the partition.

Test fit the entire assembly; then take it apart and sand it before glue–up.

Describing this small project in any greater detail could prevent you from adapting it to suit your own requirements. Here, though, are some of the adaptations that I'm preparing for use in my own music room. My record cabinets have 8 compartments, each $14^1/_2$" deep, 23" wide, and 13" high. To get the maximum use, I'm planning to reduce the length of parts "A" in the Cutting List above to, say, 14", and then mounting them 2 units

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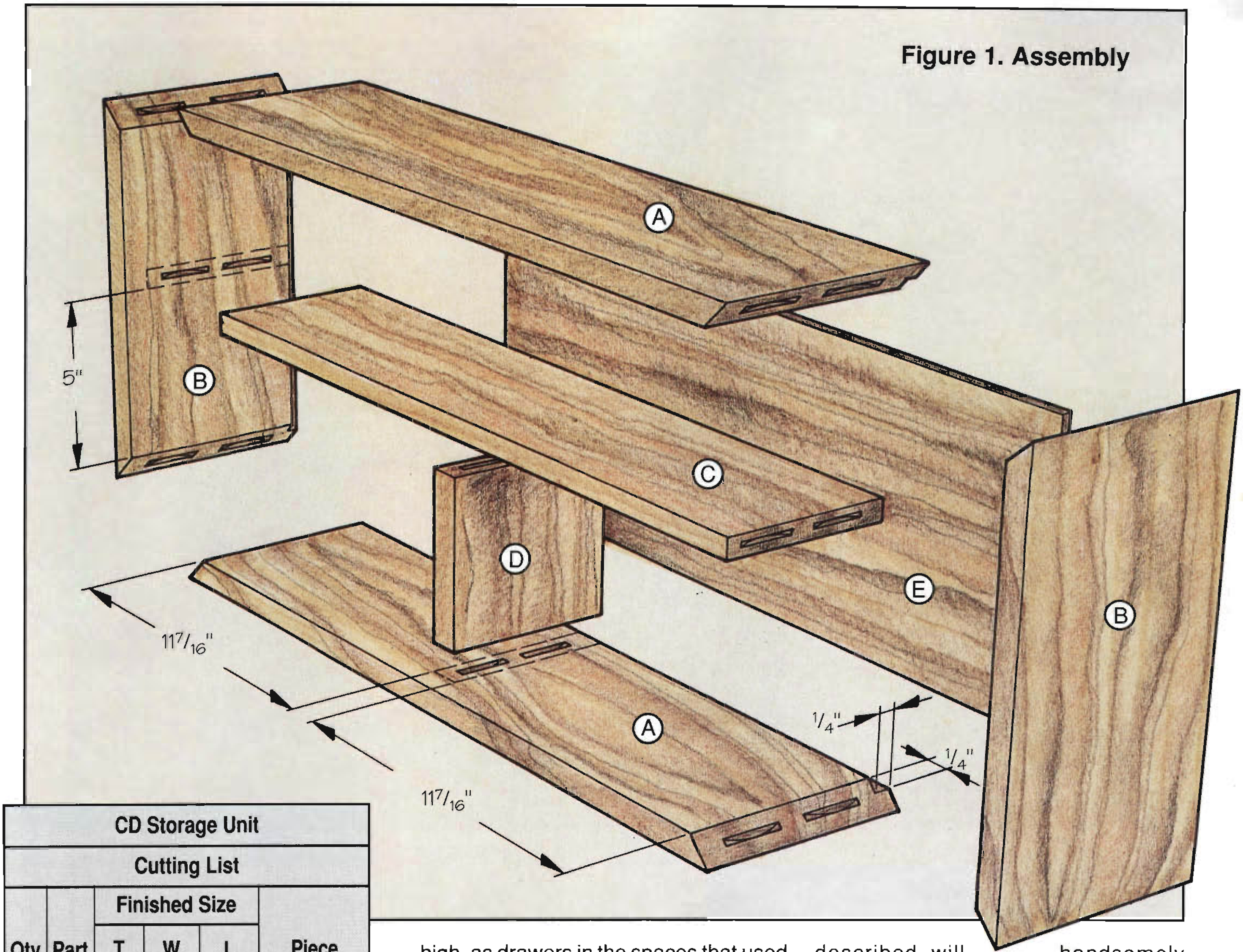
***Hugh Foster** is a part-time furniture designer/builder in Manitowoc, Wisconsin and the author of* The Biscuit Joiner Handbook *(Sterling Publishing Co., 387 Park Avenue South, New York, NY 10016).*

Figure 1. Assembly



CD Storage Unit

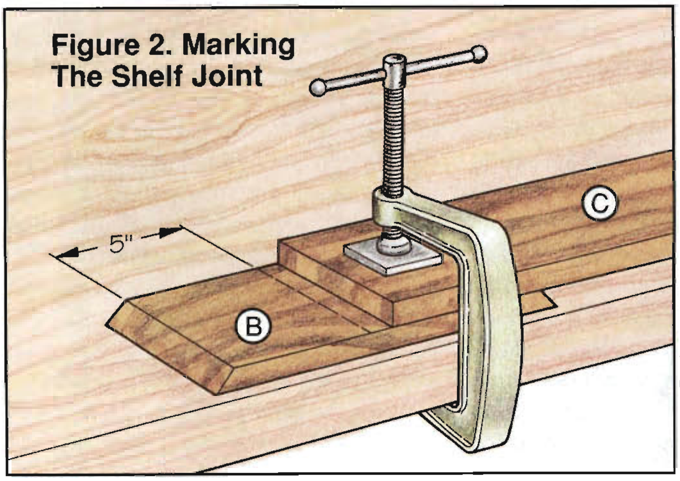
Cutting List

		Finished Size			
Qty	Part	T	W	L	Piece
2	A	5/8"	6"	24"	top & bottom
2	B	5/8"	6"	11 1/2"	ends
1	C	5/8"	5"	22 3/4"	shelf
1	D	5/8"	5"	4 13/16"	partition
1	E	1/4"	10 3/4"	23 1/4"	back

high, as drawers in the spaces that used to be for records. By using full extension glides, a pair of 14" deep CD drawers will hold 58 disks per seven running inches of space (the same space now holds 49 LP records). Compact disks indeed? Hardly.

At any rate, this simple approach I've described will handsomely house a novice compact disk collection, expand to house more serious collections, and, perhaps equally important, provide practice in using the biscuit joiner. How appropriate to make a CD storage unit using woodworking's own version of the compact disk! PW

Figure 2. Marking The Shelf Joint

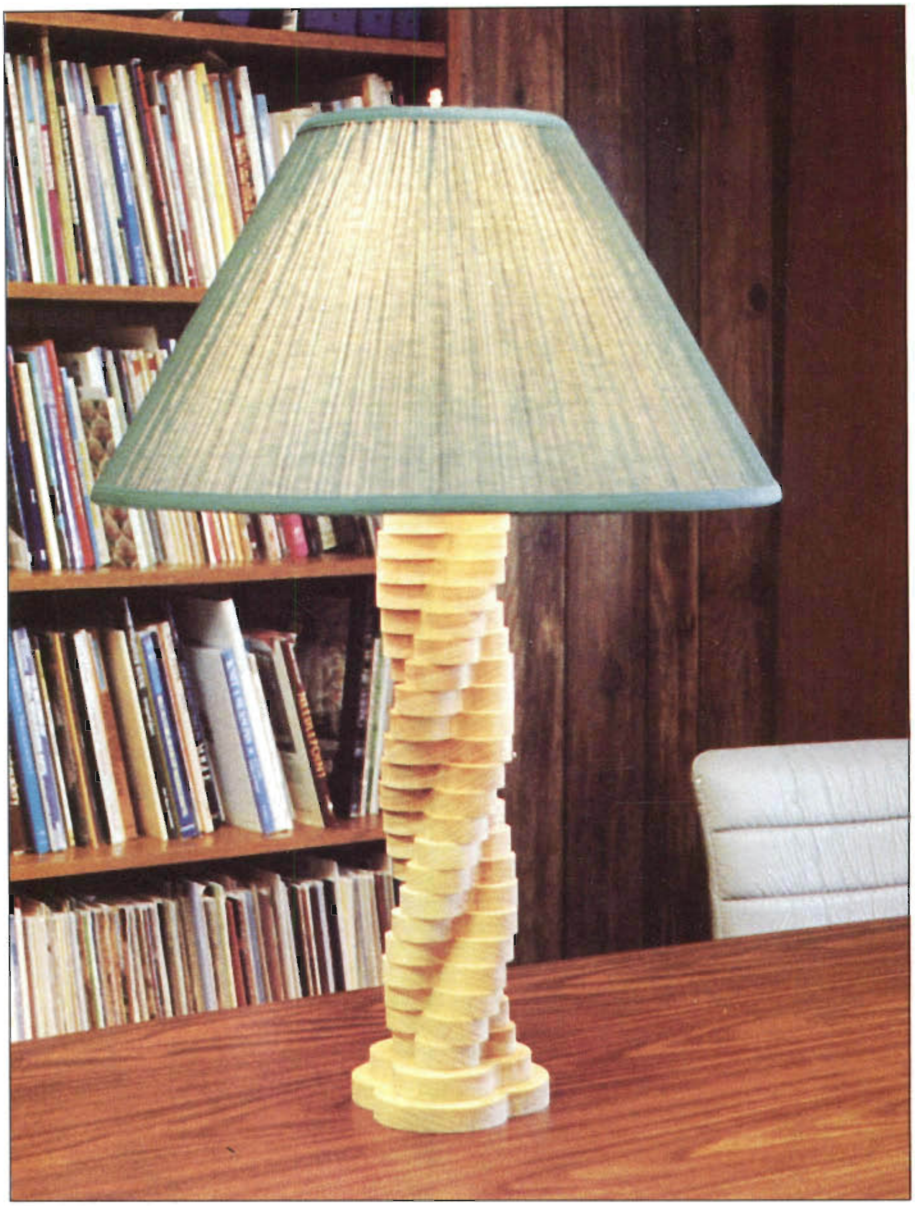


illustrations by Tom Larson

photos by the author

A Popular Woodworking Project

Spiral Lamp Bases



by Don Kinnaman

Furniture ads often feature table and floor lamps with a spiral shape. Most are ceramic, but the basic shape makes for an interesting project in wood, one that will help clean out your scrap pile. Any kind of scrap wood—any thickness, hard or soft, even plywood and particleboard—can be used. Random thicknesses can be stacked together, or thin pieces alternated with thicker ones. If you use contrasting woods, distribute them through the spiral, and don't place too many pieces of particleboard or plywood too close together. The key here is to experiment with your scraps and try to visualize the results.

The patterns provided in the PullOut™ Plans are for double, triple and quadruple spirals, as well as for the more complex design of the walnut base shown on the next page. With the help of a photocopier, you can size the patterns up or down to meet your needs. Lamp bases should, of course, be relatively large for good support.

Select your wood and trace the patterns on it, packing them in as close as possible together. Leave gaps between pieces at least as wide as the kerf of your band or scroll saw. You can also make a photocopy of the pattern for every piece and contact or rubber cement them right to the wood. Cut out the pieces using the lines on the paper as your guide. When gluing, make sure the cement holds down the patterns along their outside lines; it's not necessary or desirable to glue down the interior portions. If you trace your patterns on the wood, don't forget the center holes.

Cut the pieces out carefully on the scroll saw. If you have a number of them placed closely together on a single board, saw them apart on the band saw first. If you're planning to carve and sand a smooth base like the walnut one, a little roughness in the cutting won't matter, but it will if you want a base like the taller one. The smoother your cuts the first time, the less sanding later. If you want to save time and make all cuts on the band saw, experiment with triangles, squares and other shapes that require only straight line or simple curve cutting. You'll probably need to make a number of test pieces, stack and offset them in various ways in order to get an idea of what the finished base will look like—it's hard to visualize the shape of the final column while holding just the pattern or even a piece or two.

Once the pieces are cut (and sanded if they're not to be carved), drill the center hole in each. If you have a drill press, you can probably stack and drill two or three at

---

***Don Kinnaman** is a retired high school woodshop teacher from Phoenix, Arizona, and a frequent contributor to* Popular Woodworking.

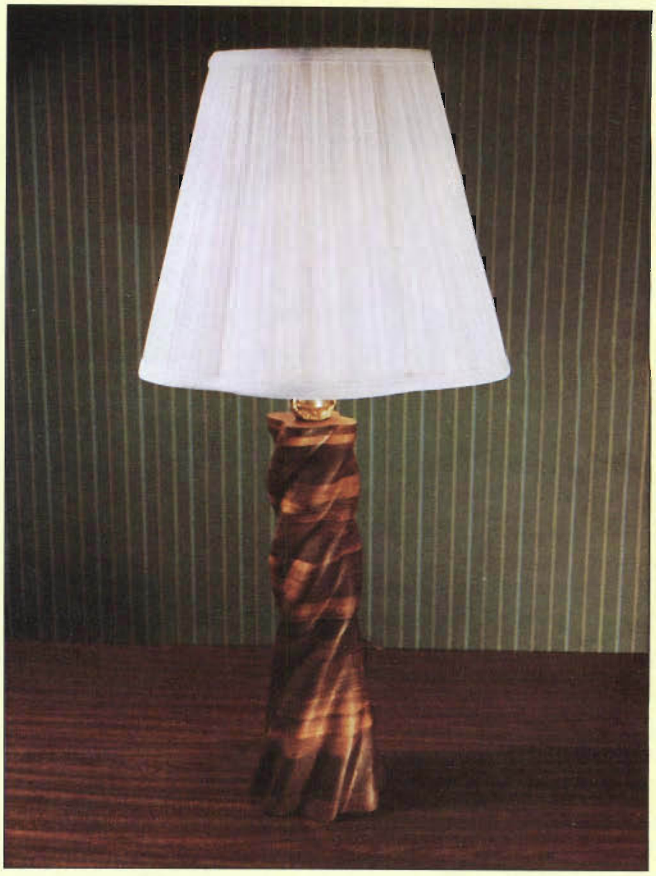
The tighter curves of some pieces are best cut on the scroll saw (top photo). If you want to smooth the spiral, belt sanding is the fastest way to go (above).

a time, depending on size and thickness. The hole diameter should equal the size of the lamp pipe, the continuous–thread pipe which carries the cord. It's commonly available in $^{3}/_{8}$" diameter and if you use a $^{3}/_{8}$" bit, the fit will be tight enough to hold everything still while you experiment with turning the pieces. Whether you want a tight spiral or a long slender one, its shape is determined by how far each piece is offset. You might find it helpful here to mark each piece at the same point; you can then keep the offset consistent by eyeballing the reference marks. For a long spiral, keep the reference points about $^{1}/_{4}$" apart; a short, tight spiral requires an offset of $^{3}/_{8}$" to $^{1}/_{2}$" or more.

The bottom piece will need to be counterbored for the washer and nut; bore at least $^{1}/_{2}$" deep to allow clearance for the cord as well. Rout a $^{3}/_{8}$" wide X $^{1}/_{4}$" deep channel for the cord to trail out.

Depending on its size and shape, you may want to make a separate base piece, thicker and wider than the pieces above it. The smoothed walnut base in the photo was assembled from pieces graduated in overall size and shape. As a glance at the patterns provided in the PullOut™ Plans will show, the pieces get smaller for the first few inches and remain identical the rest of the way up. For a way of achieving the smooth appearance of the walnut base, see the sidebar.

When you've found an arrangement you like, glue the pieces together and clamp the assembly with a lock nut and 2" fender washers at each end. If the base is not to be carved into a smooth spiral, all that remains is to finish the wood, apply felt to the bottom, and install a lamp fixture, cord, and a suitable shade. **PW**



Smooth *Spirals*

There's so much end grain exposed in a stack like this that it's nearly impossible to carve. We decided to sculpt it with a belt sander. To proceed efficiently, the job required two of us, dressed in dust masks and goggles.

We mounted the blank between centers on the lathe. One guy held it in place, slowly rotating it while the other guy worked the surface under his belt sander. We started with 35–grit, and with the goal of rounding the cliffs down to valleys.

By adjusting the belt so that $^{1}/_{2}$" or so hangs out past the rollers, you can dig down into the V's and blend the surfaces together. If you're too aggressive you'll shred your belts faster, but you'll have to be ready to lose a few in any event. They tend to come apart in strips; if you've got 2" of belt left on the machine, you've still got enough to work with.

After the belt sanding, you can do a lot of final shaping with a small pad sander and 80–grit paper. You'll find, however, that no machine will get the marks out of the grooves; you'll have to smooth them by hand to get a surface that's ready for a finish. **PW**

A Popular Woodworking Project

Dinosaur Bank and Bookends

by Devore O. Burch

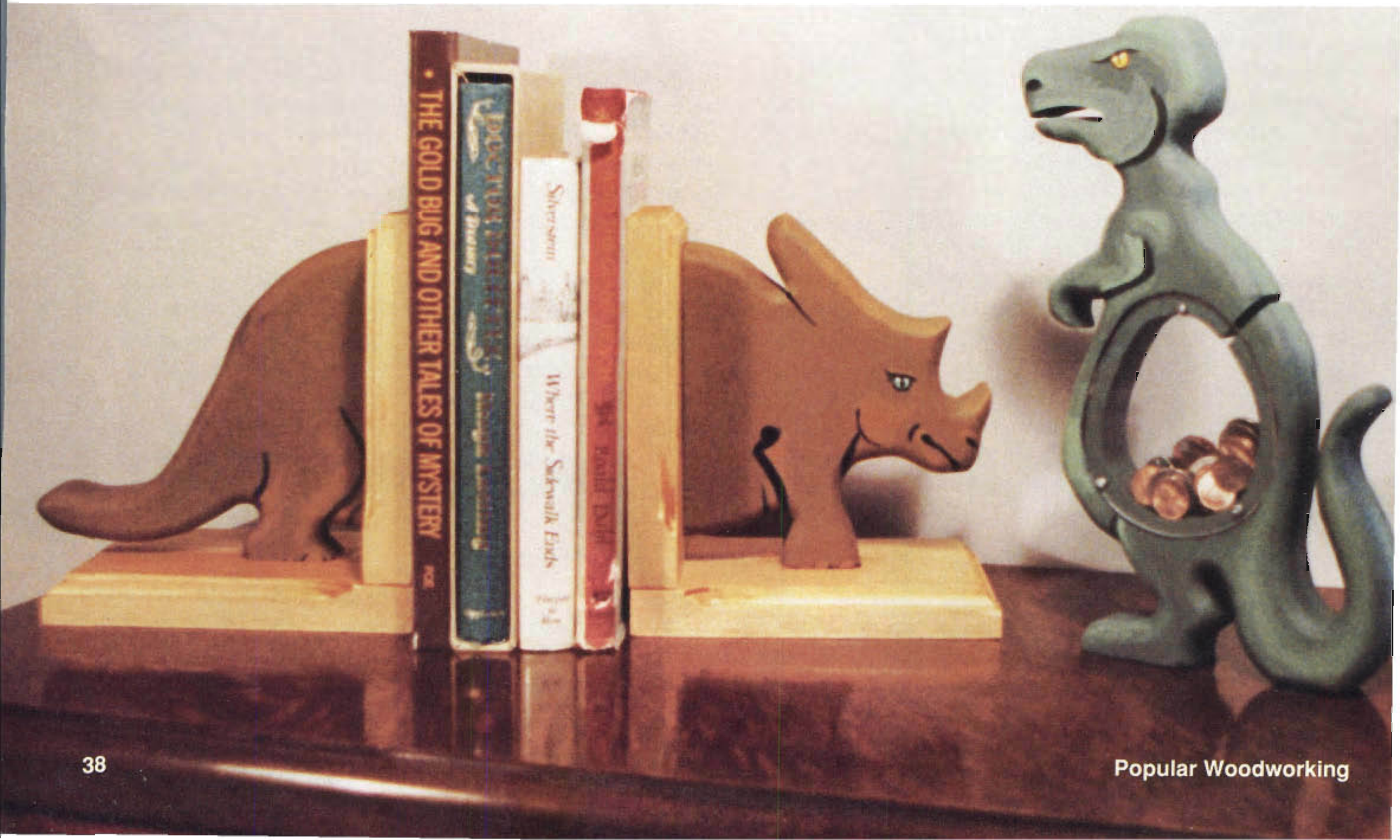
Dinosaurs have always been popular with children and these charming pieces make excellent gifts. They are easy to make and do not require expensive woods; yellow pine makes very attractive wooden toys. I make these from common construction–grade 2 X 8's. If you are near a construction site, many scrap pieces long enough to use can be found. Even if you have to buy the lumber, it is not expensive.

To make the Tyrannosaurus bank, first trace the body profile from the full–size pattern in the PullOut™ Plans section. Before cutting out the body, make the coin cutout and rout the rabbet around the cutout. Now saw out the perimeter profile and smooth out the saw marks. You can leave the edges square if you like, or round the edges using a piloted $^{1}/_{4}$" round–over bit mounted in a router table. The windows over the coin cavity are made from $^{1}/_{8}$" plexiglass and attached with three #4 X $^{1}/_{2}$" round head wood screws on both sides.

To make the Triceratops bookends, cut out the pattern and round the edges, then place the feet against the fence of your radial arm saw, and crosscut him in half. The base and uprights for the bookends are made from four identical pieces of 1" X 5" X 7" material. I routed a stopped ogee detail on three edges of each piece. Attach the base to the upright with two #8 X 2" flat head wood screws, countersunk on the underside. Countersink the screws a little deep to keep the screw heads from scratching the surface they sit on. Attach the dinosaur pieces to the base and upright with #8 X 2" wood screws.

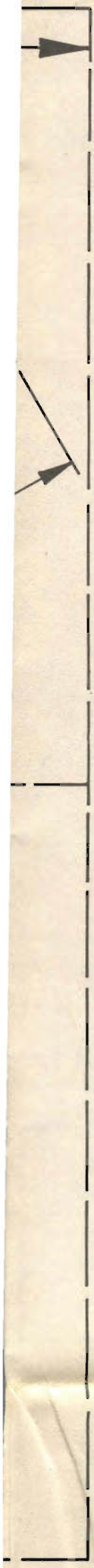
Many children's toys are left unfinished, but one coat of sanding sealer or white shellac before assembly will make it easy to wipe off fingerprints and smudges. If you want to paint them as shown in the photos, spray them first with a black primer. We used artists' acrylics, mixing a touch of black with the color for the base coat and then using the color by itself for the highlights. PW

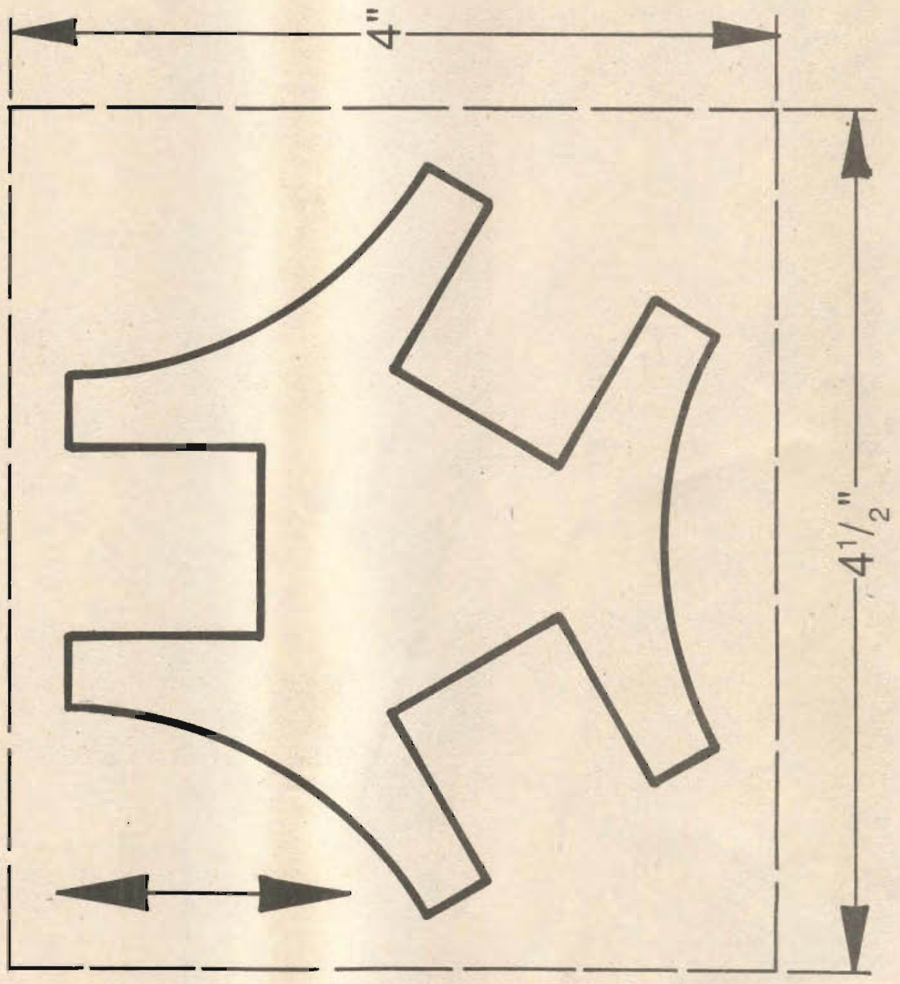
***Devore O. Burch** is a woodworker in Fort Worth, Texas.*



PullOut™ Plans

Popular Woodworking No. 59
March 1991
Pages 39—70

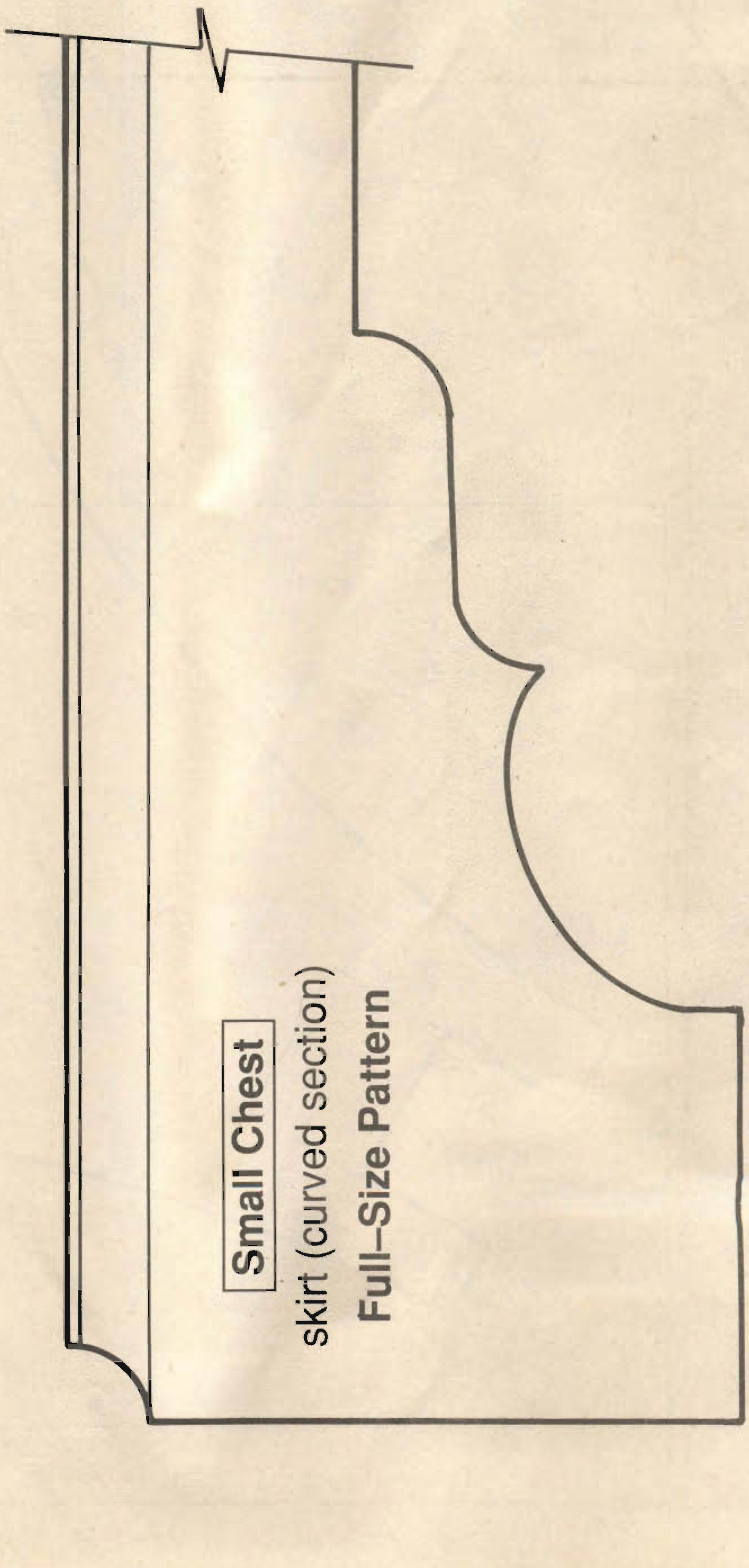




Occasional Table

center leg support (small table)

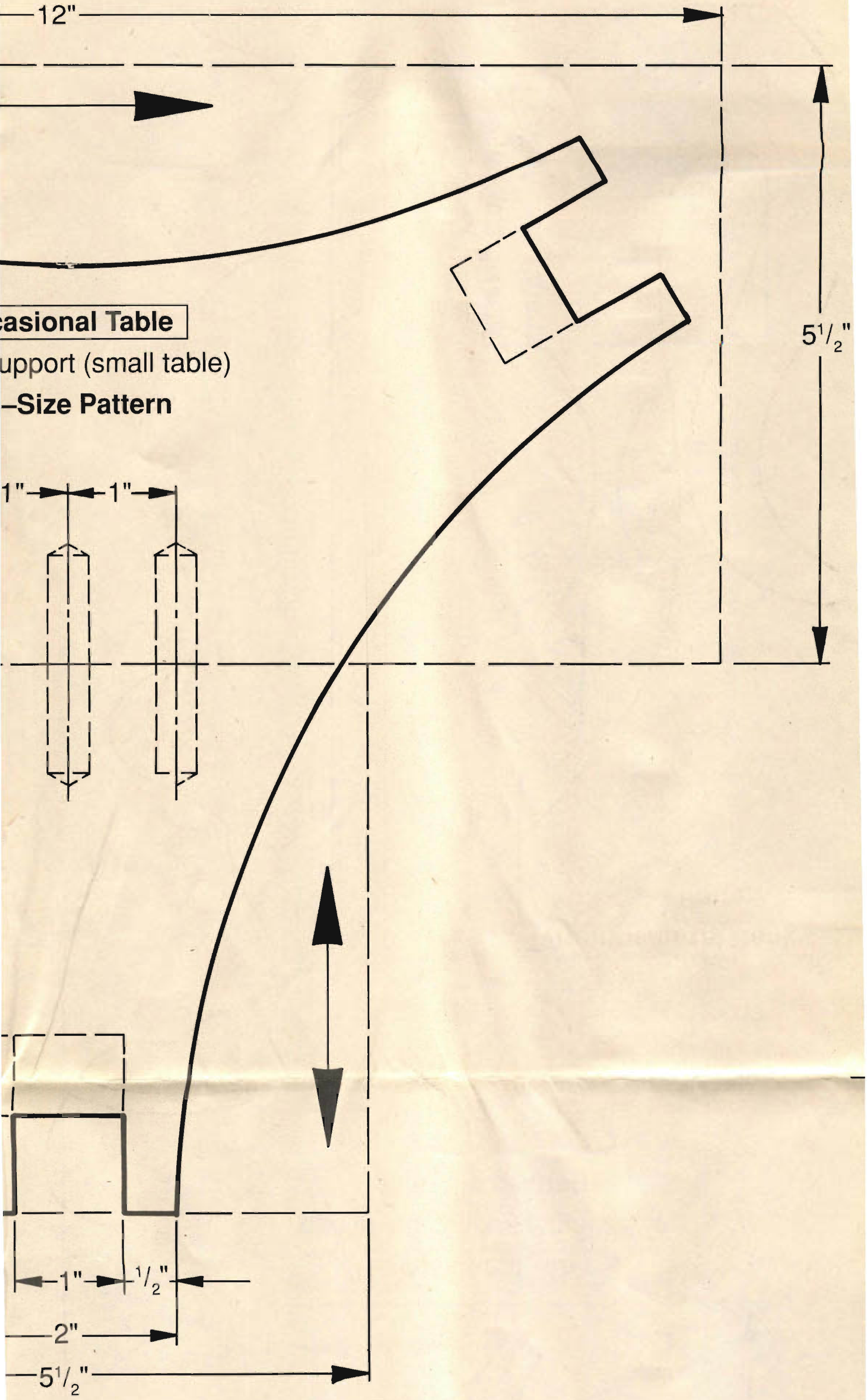
Full–Size Pattern



Small Chest

skirt (curved section)

Full–Size Pattern



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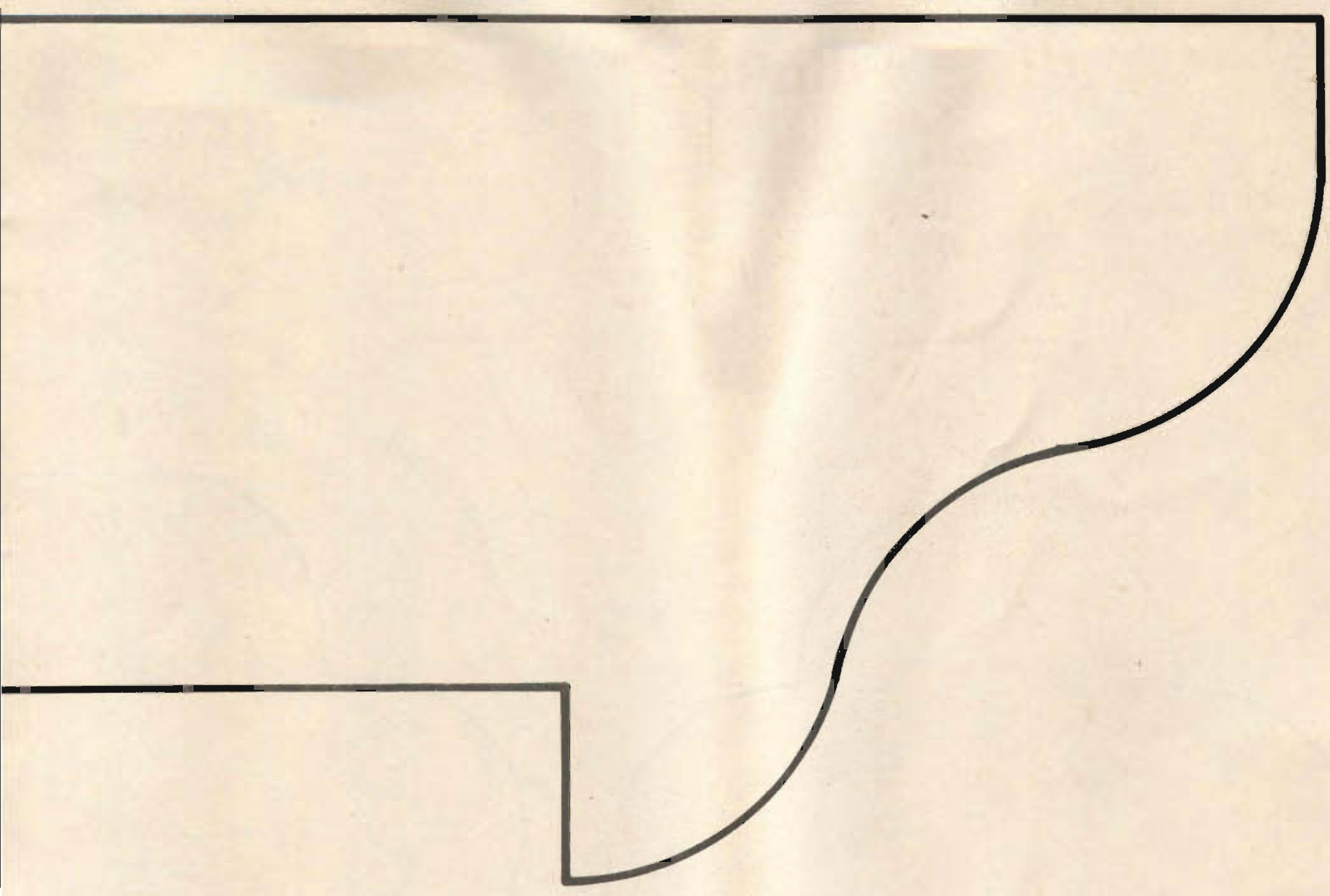
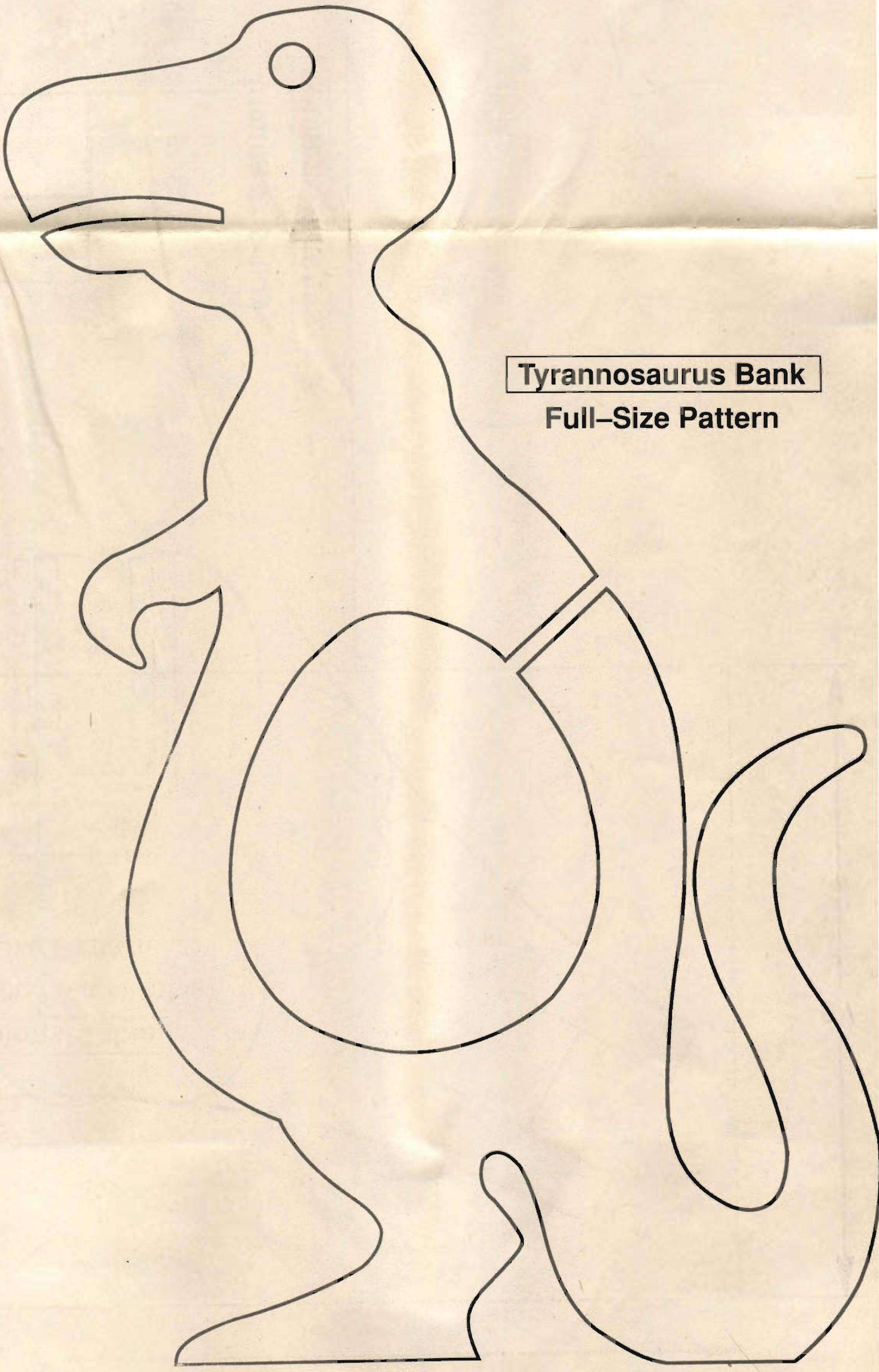
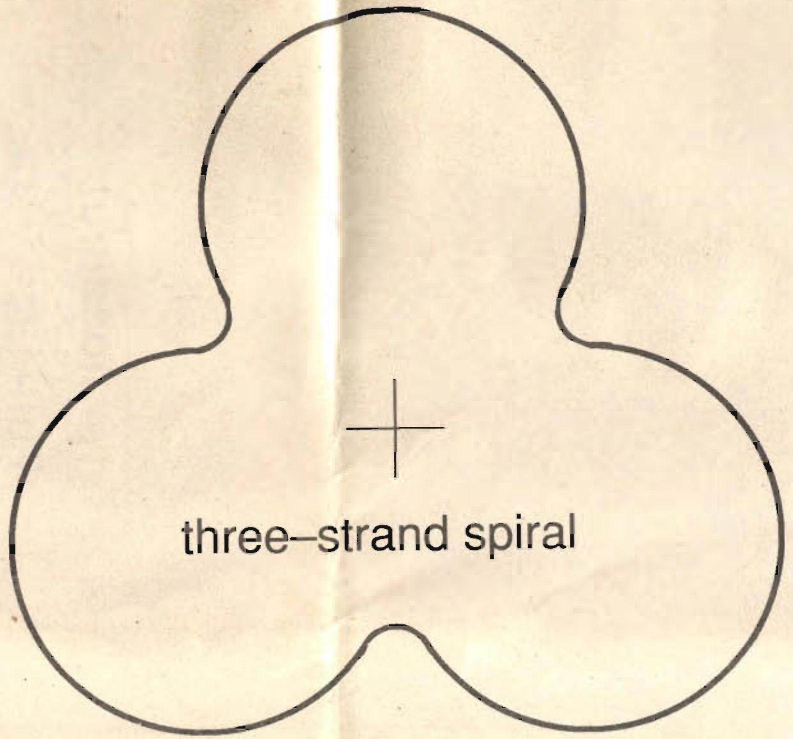
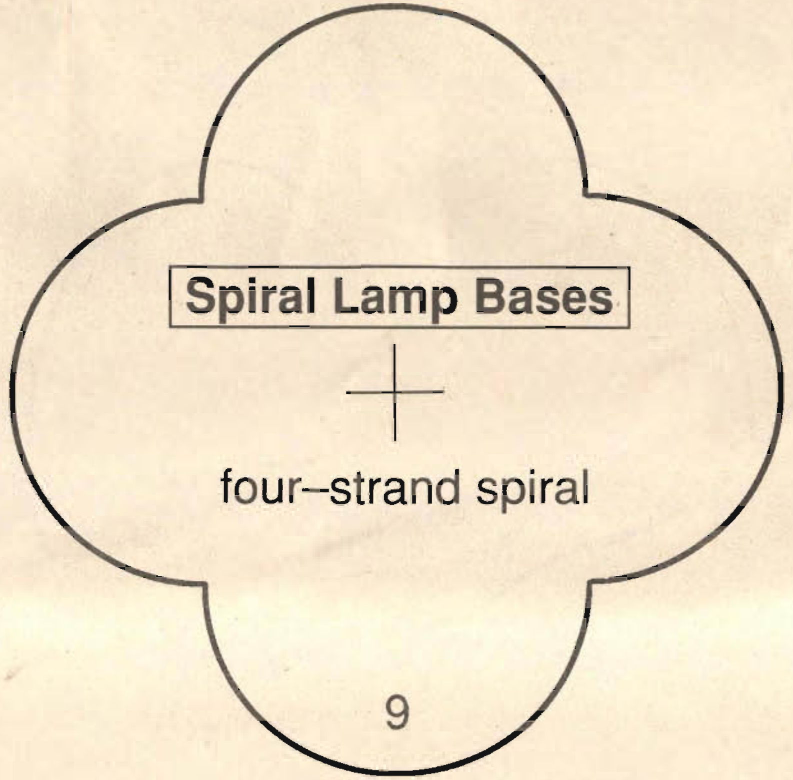




Tyrannosaurus Bank

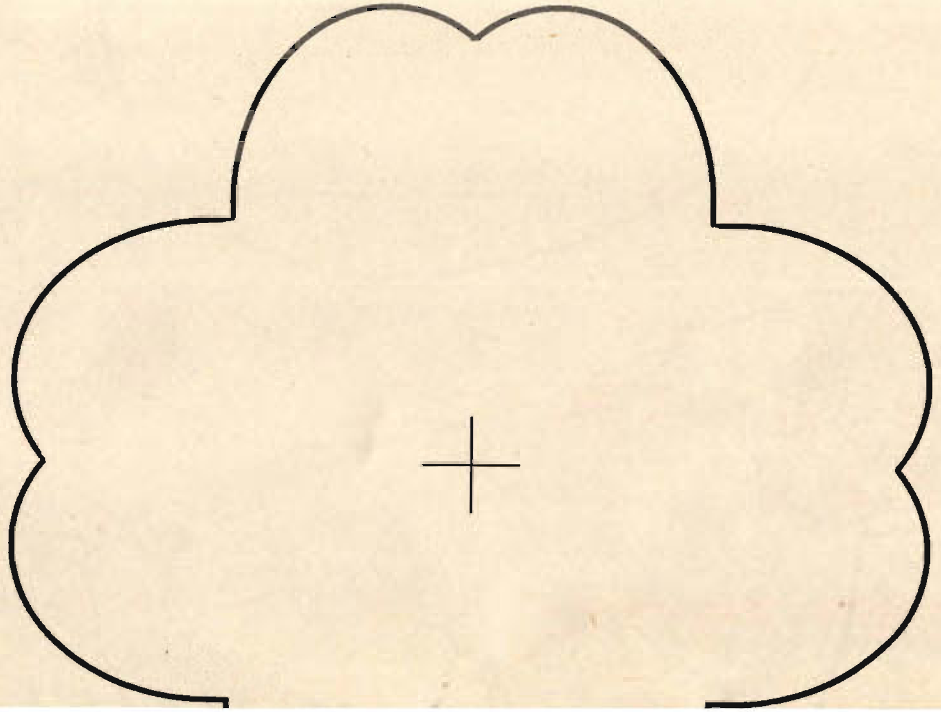
Full–Size Pattern

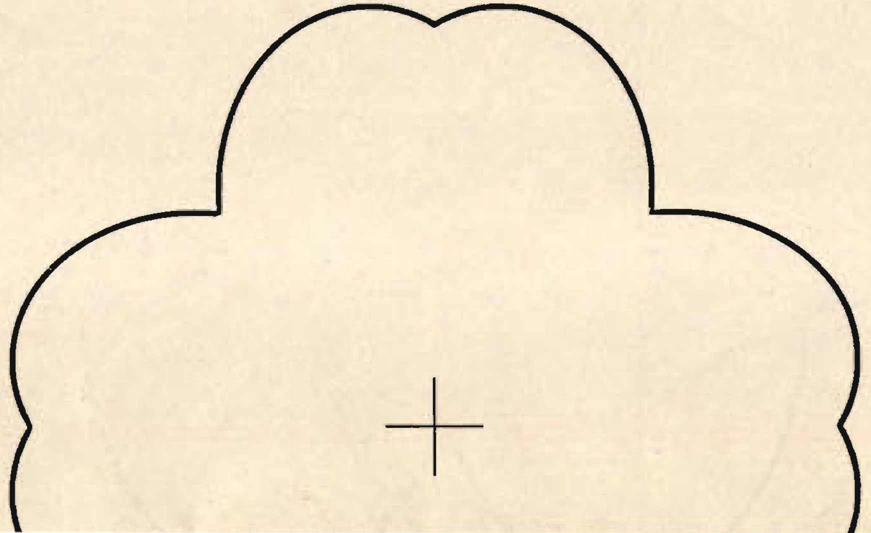




Spiral Lamp Bases

Full–Size Pattern

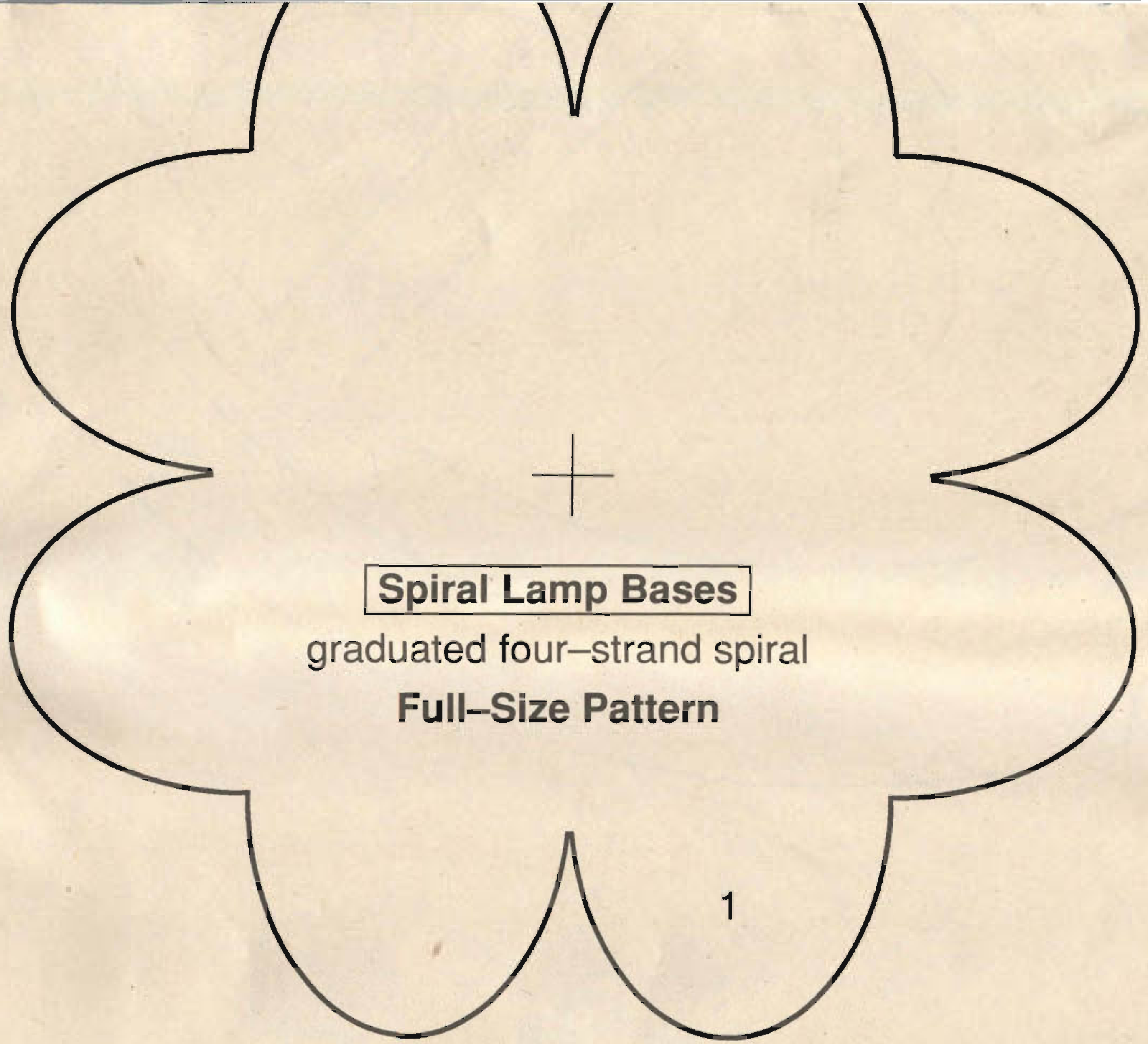




Spiral Lamp Bases

graduated four–strand spiral

Full–Size Pattern



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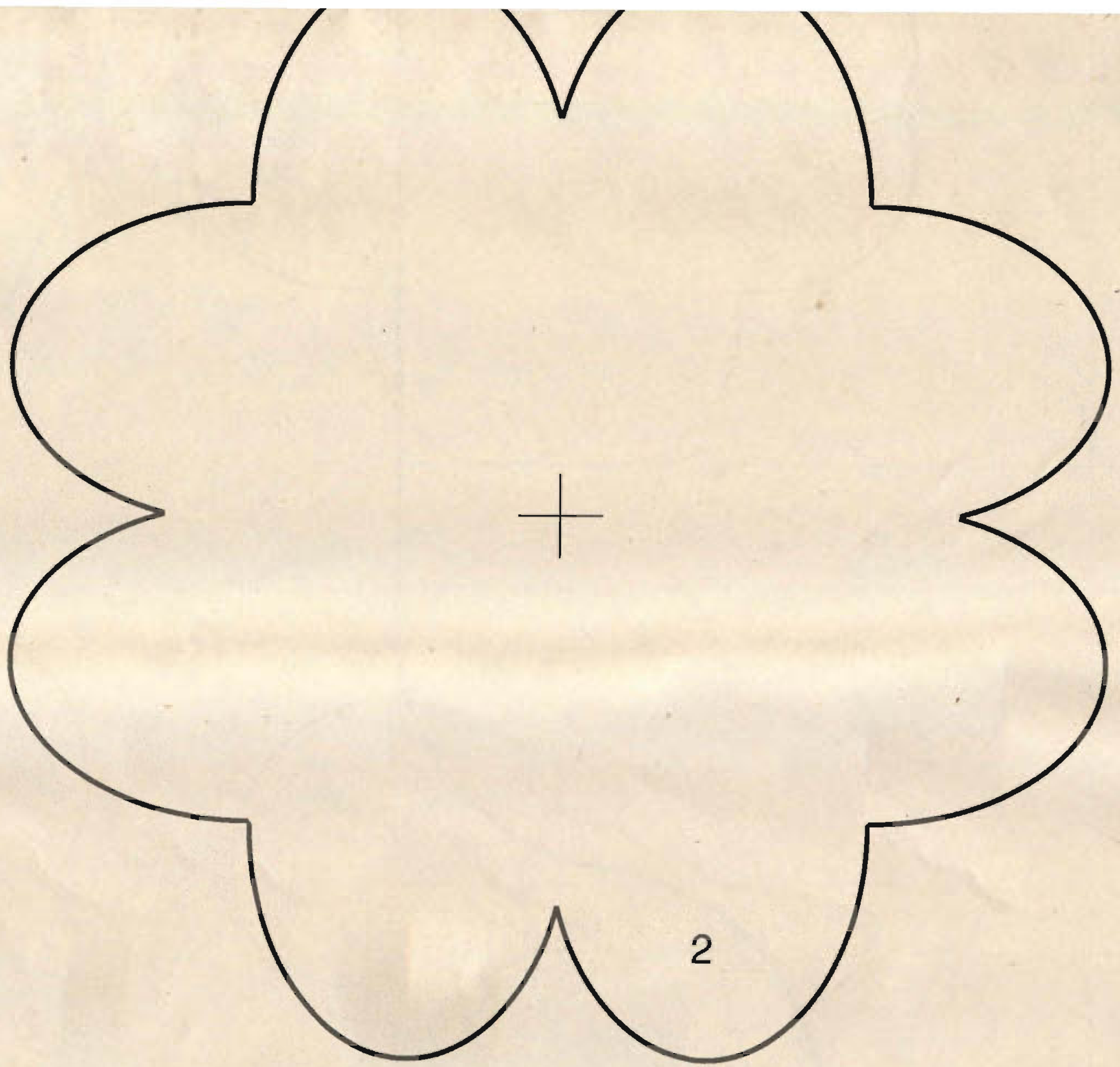

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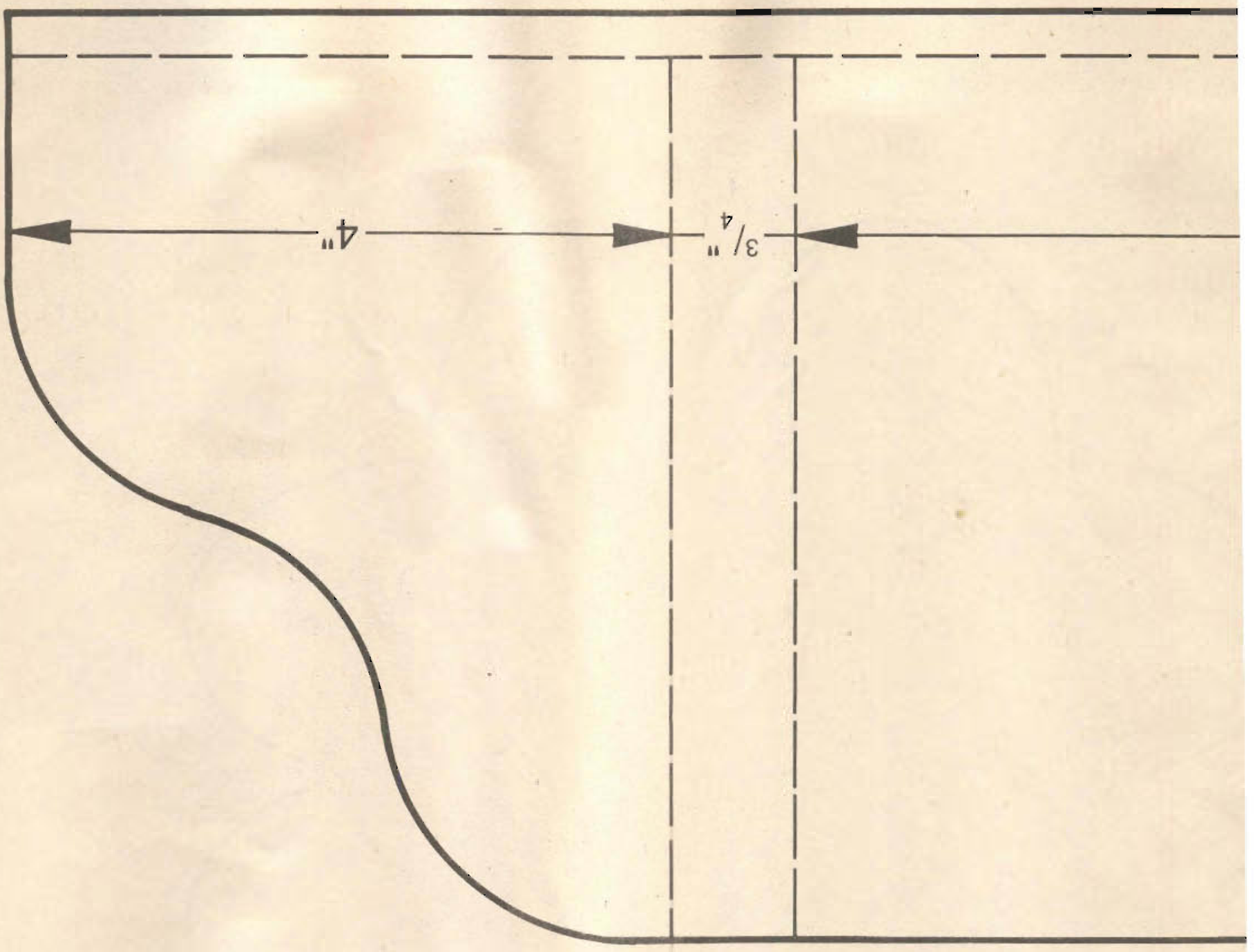
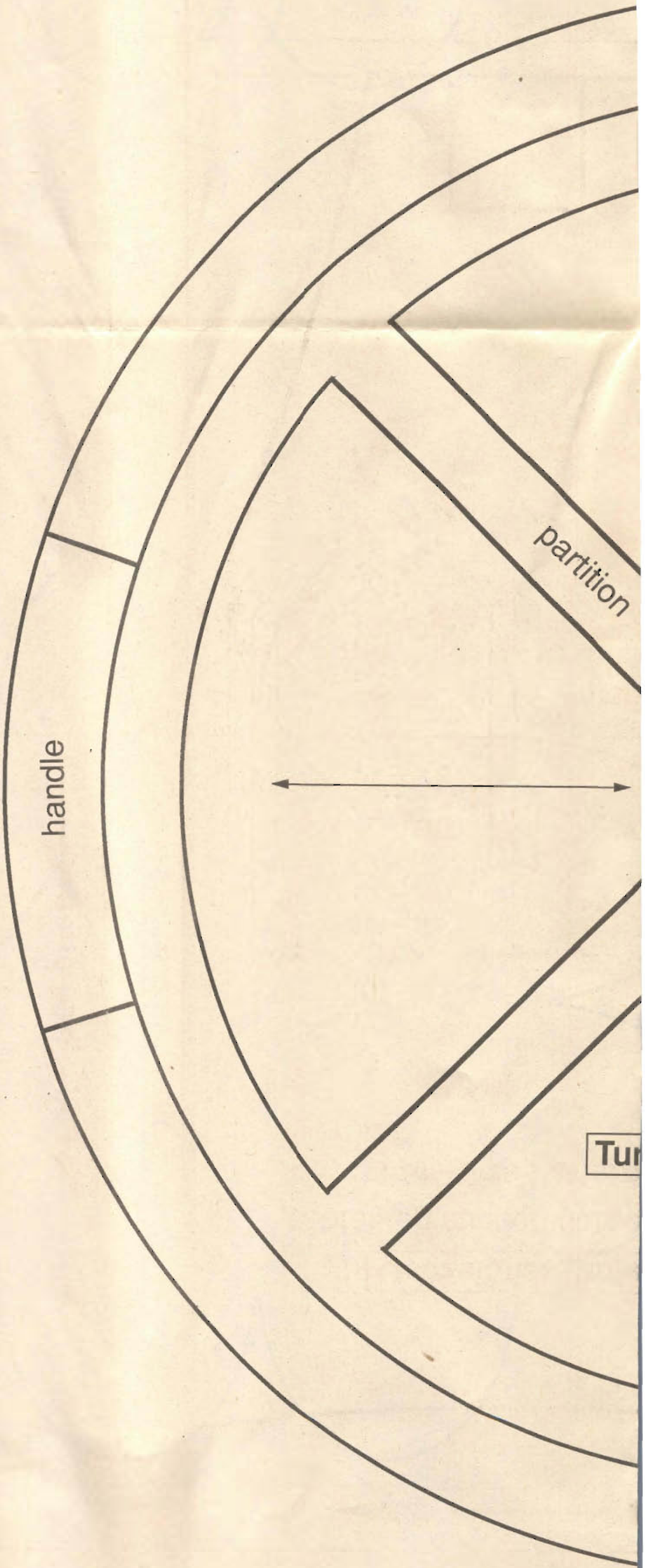

4"
3/4"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handle
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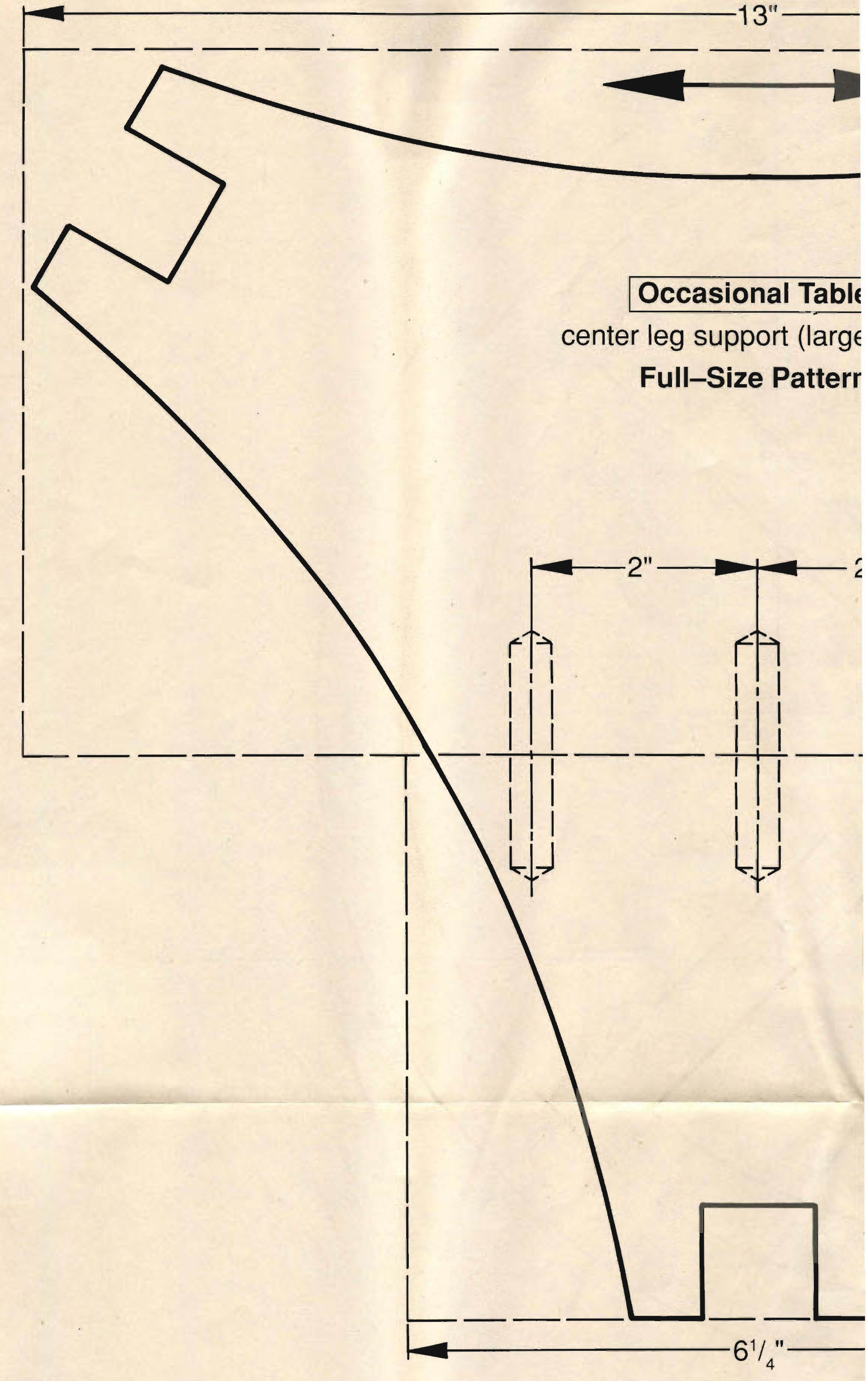
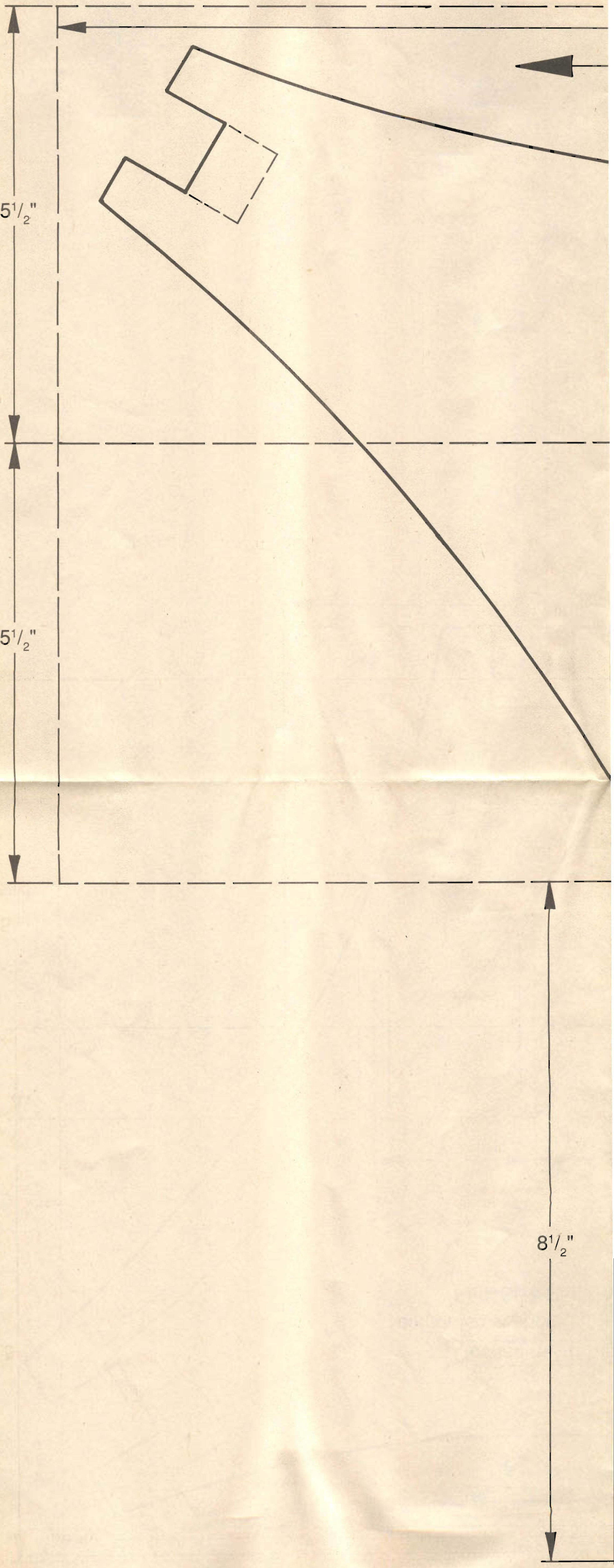


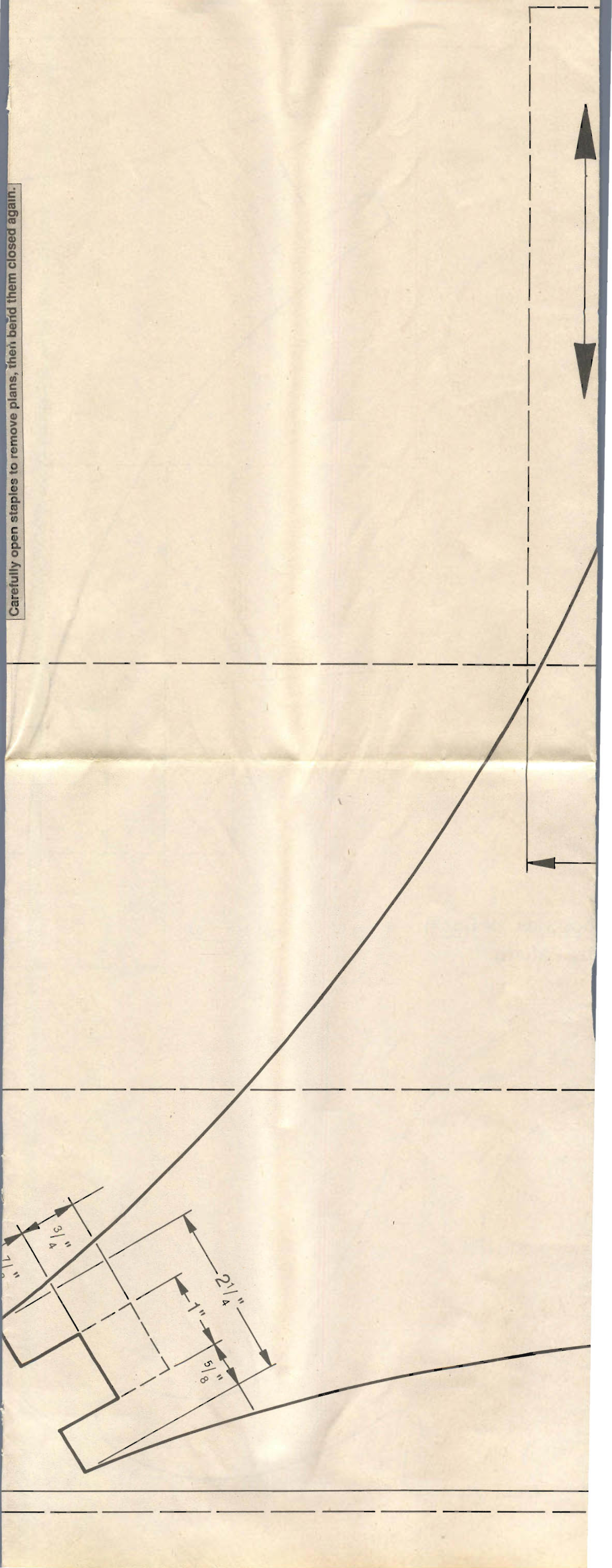
Occasional Tabl

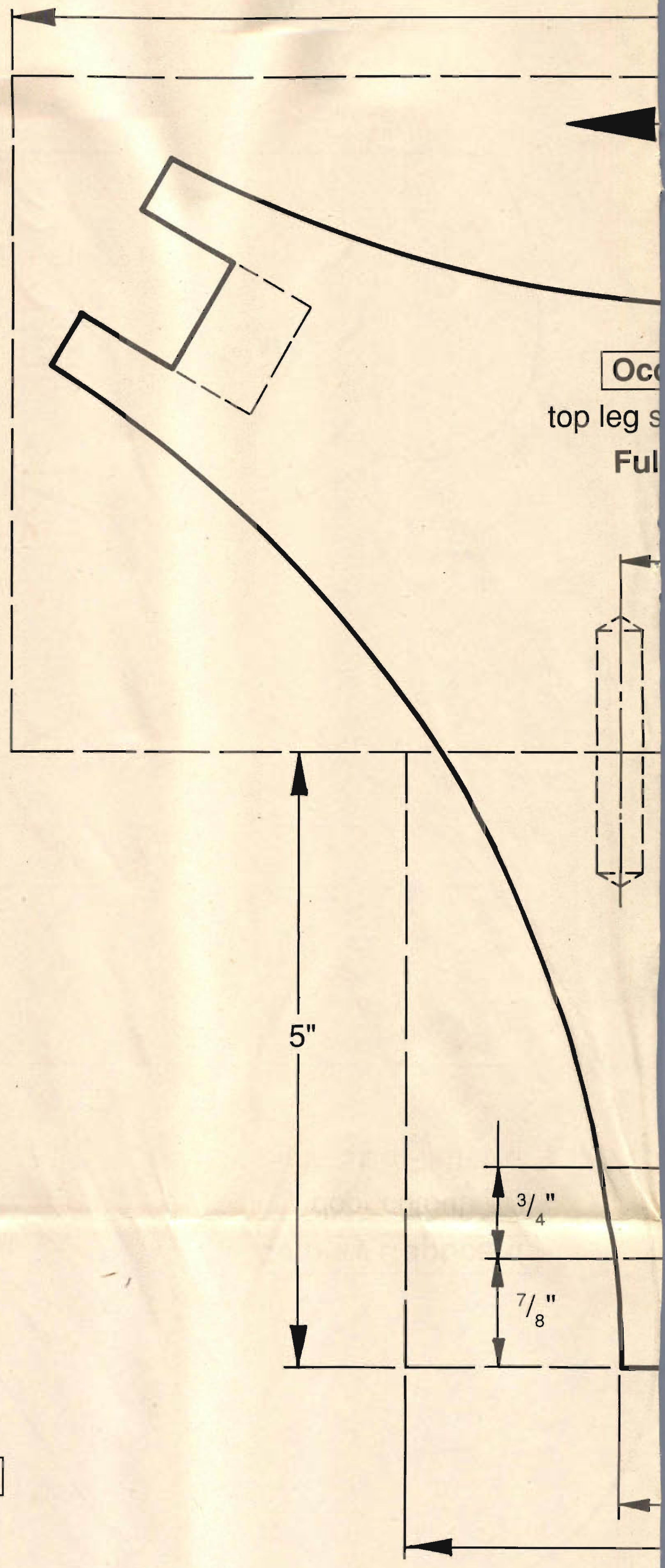
center leg support (larg

Full–Size Patter


5¹/₂"
5¹/₂"
8¹/₂"

Carefully open staples to remove plans, then bend them closed again.





Occ
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Ful

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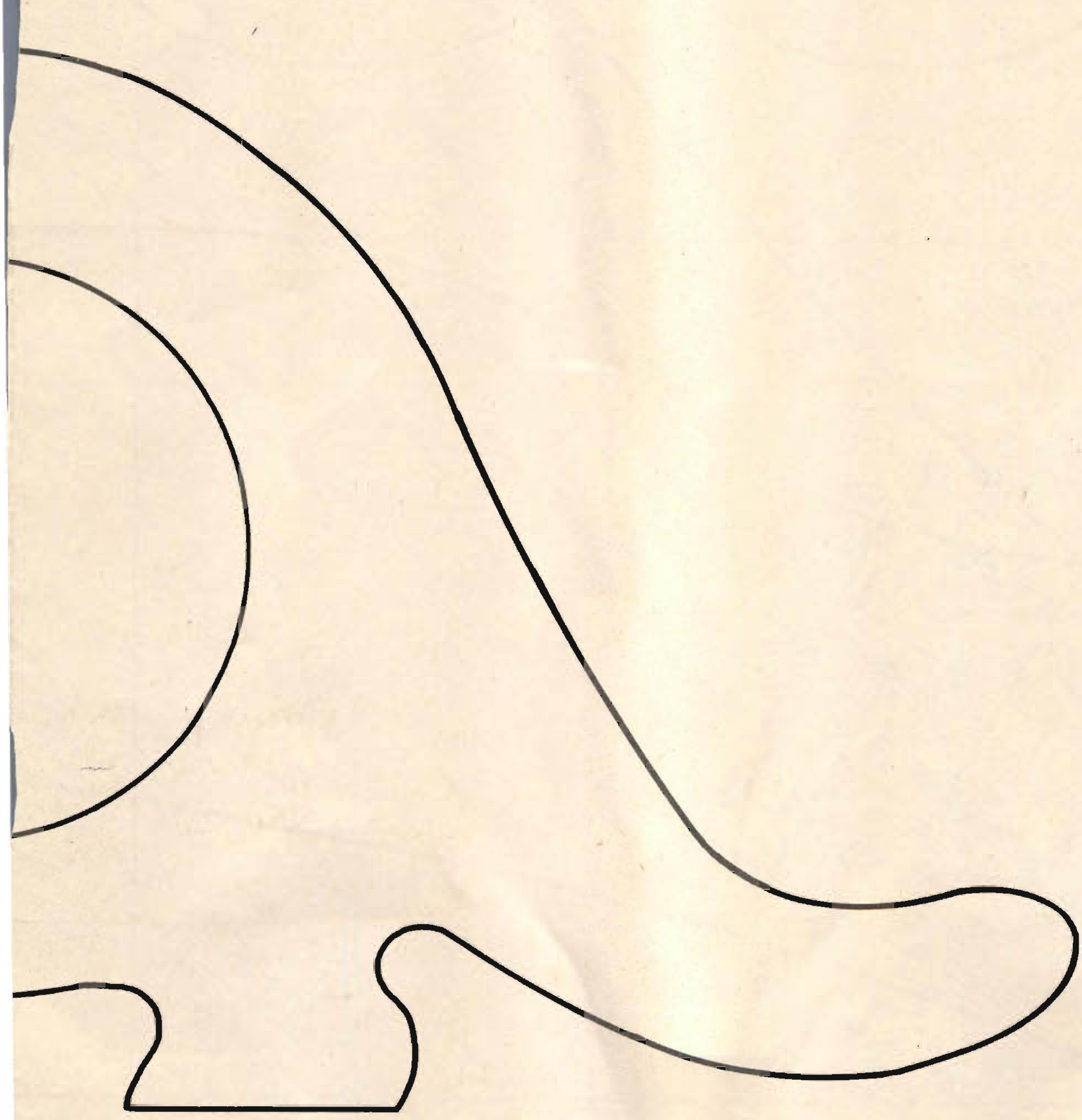
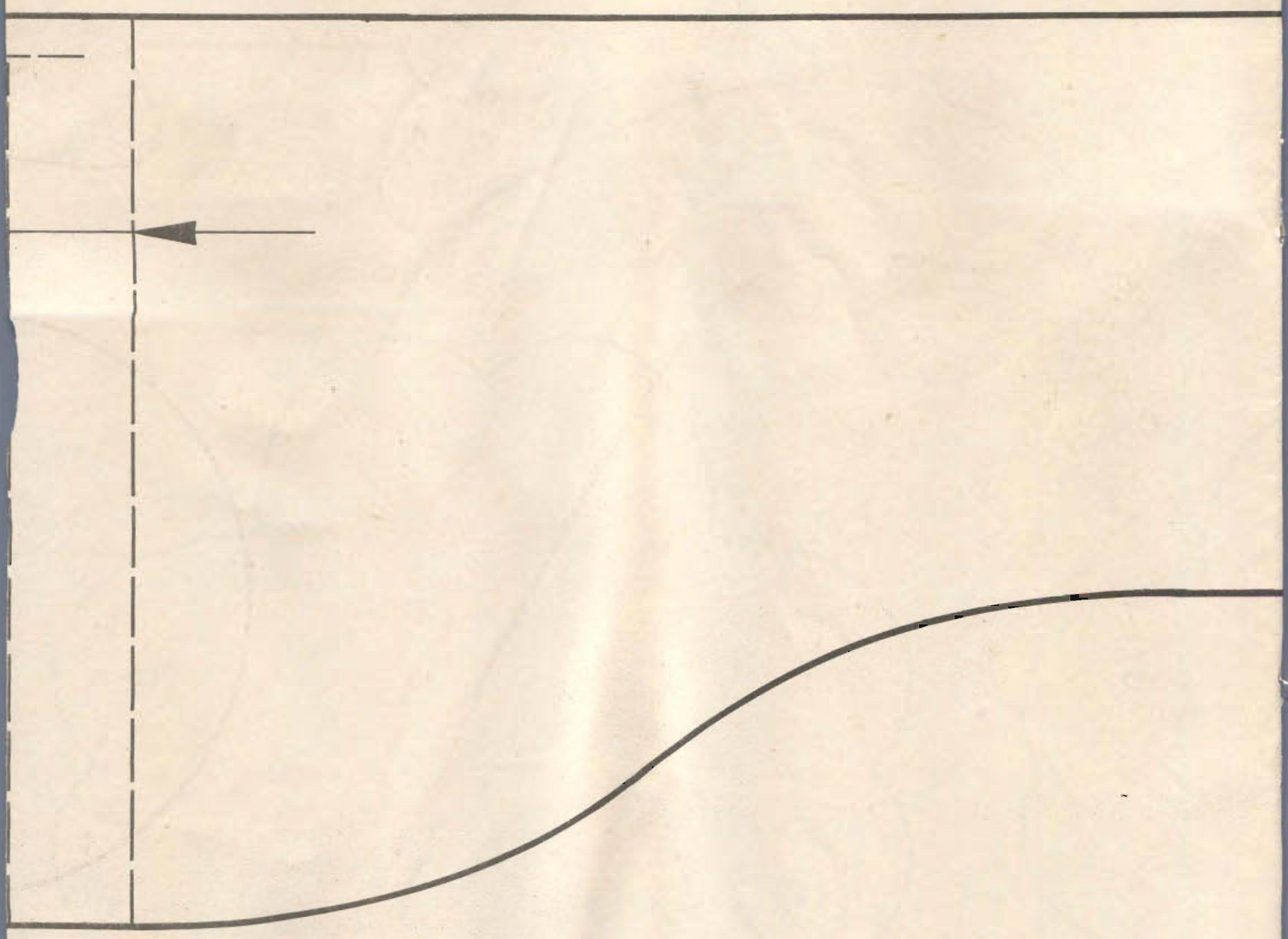
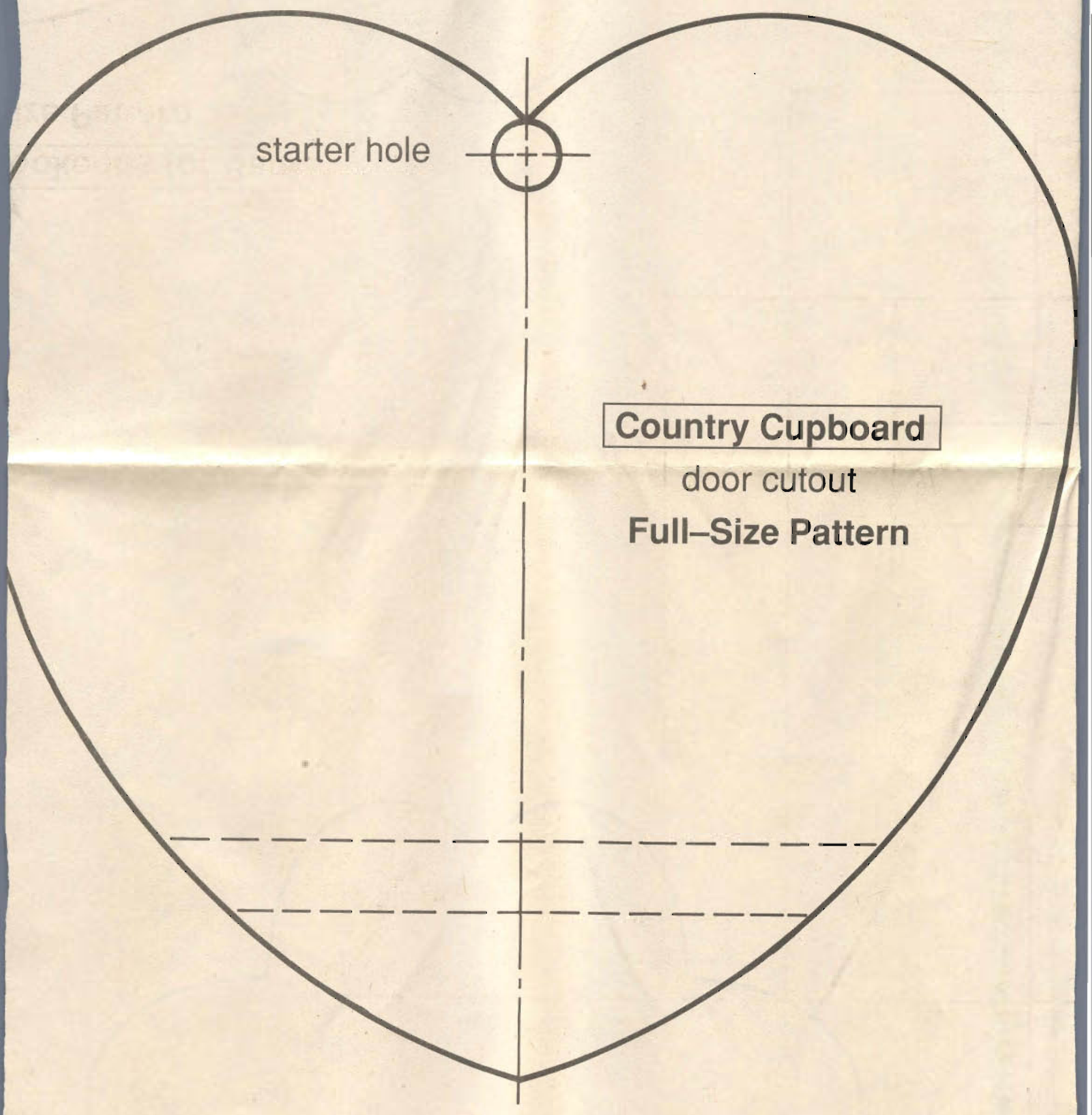
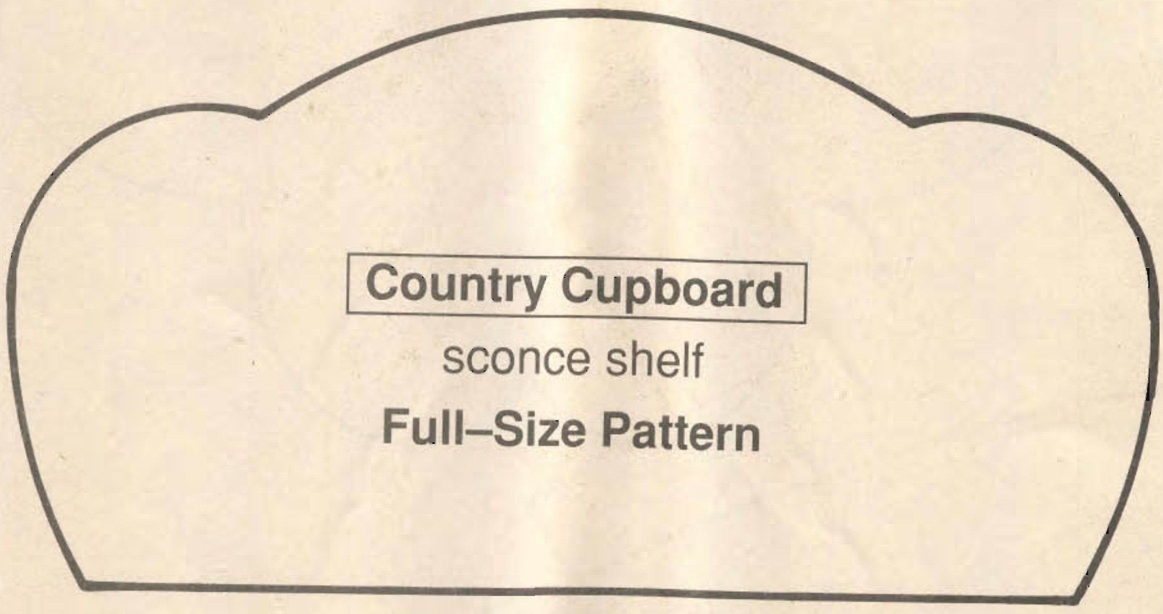
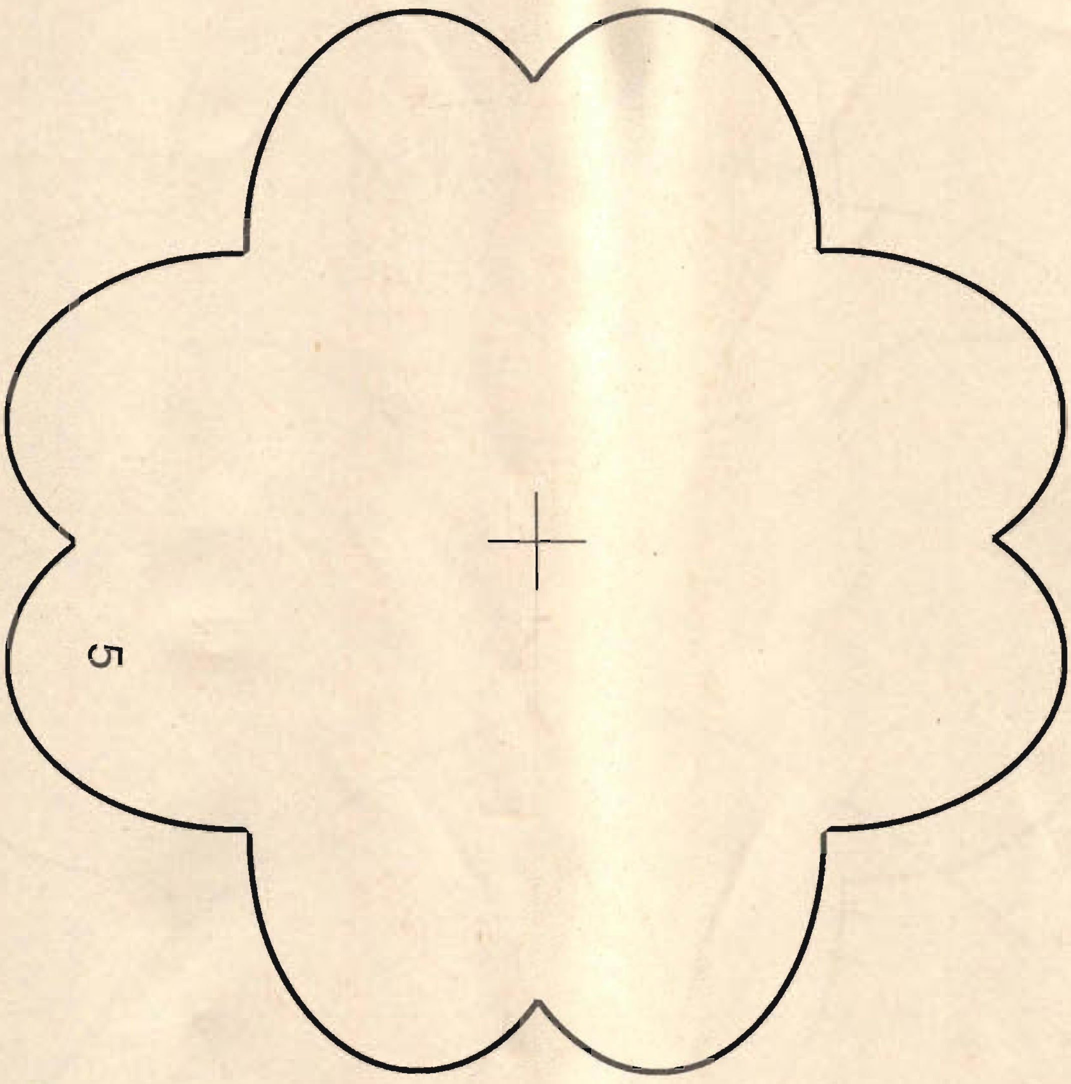





starter hole
Country Cupboard
door cutout
Full–Size Pattern


Country Cupboard
sconce shelf
Full–Size Pattern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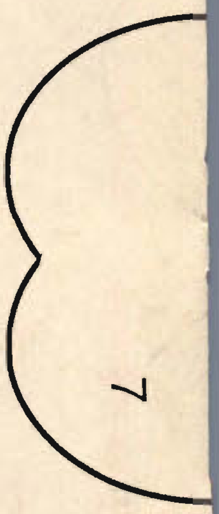
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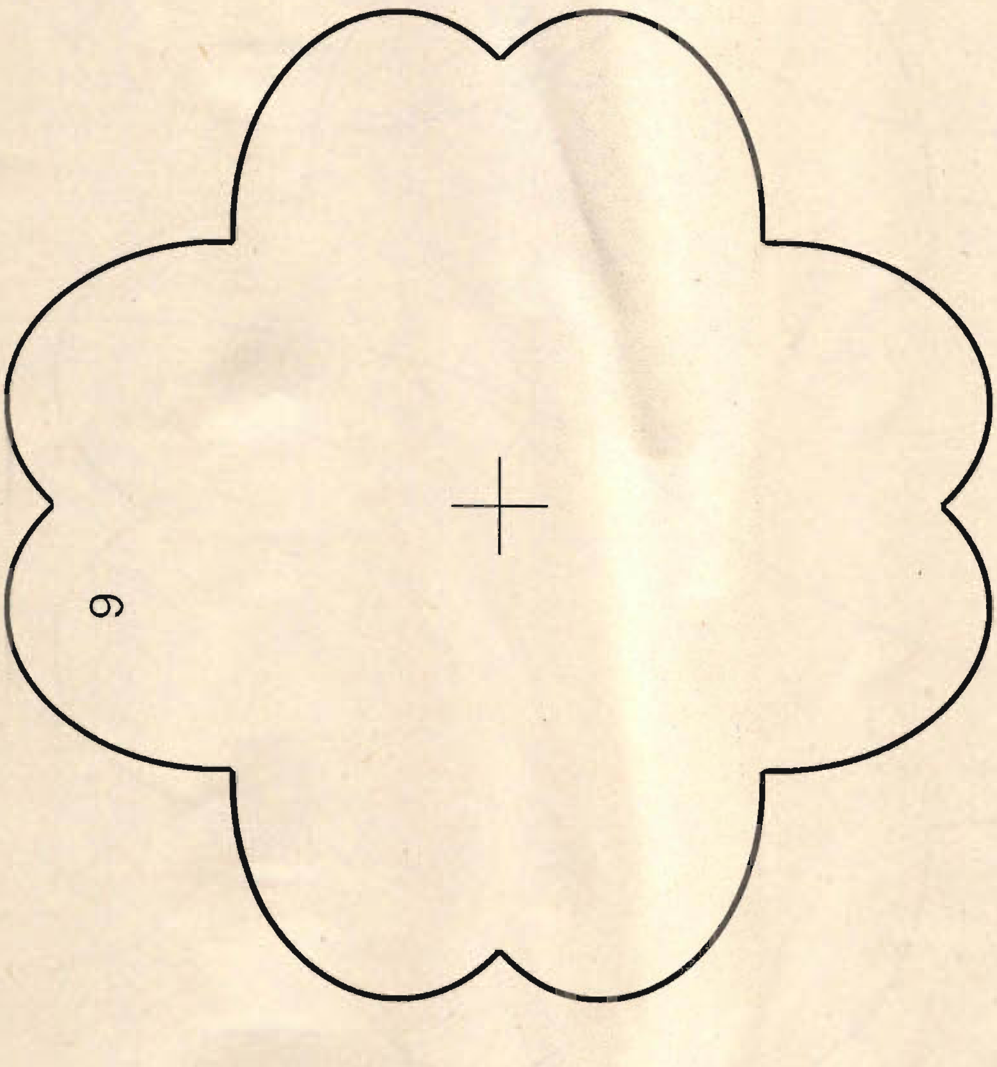
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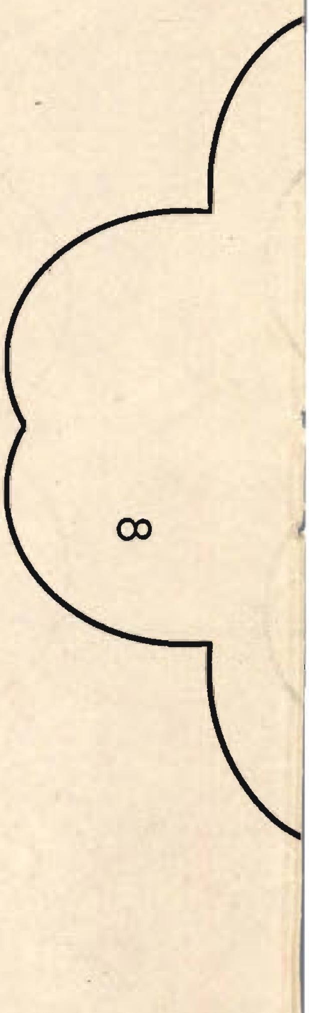
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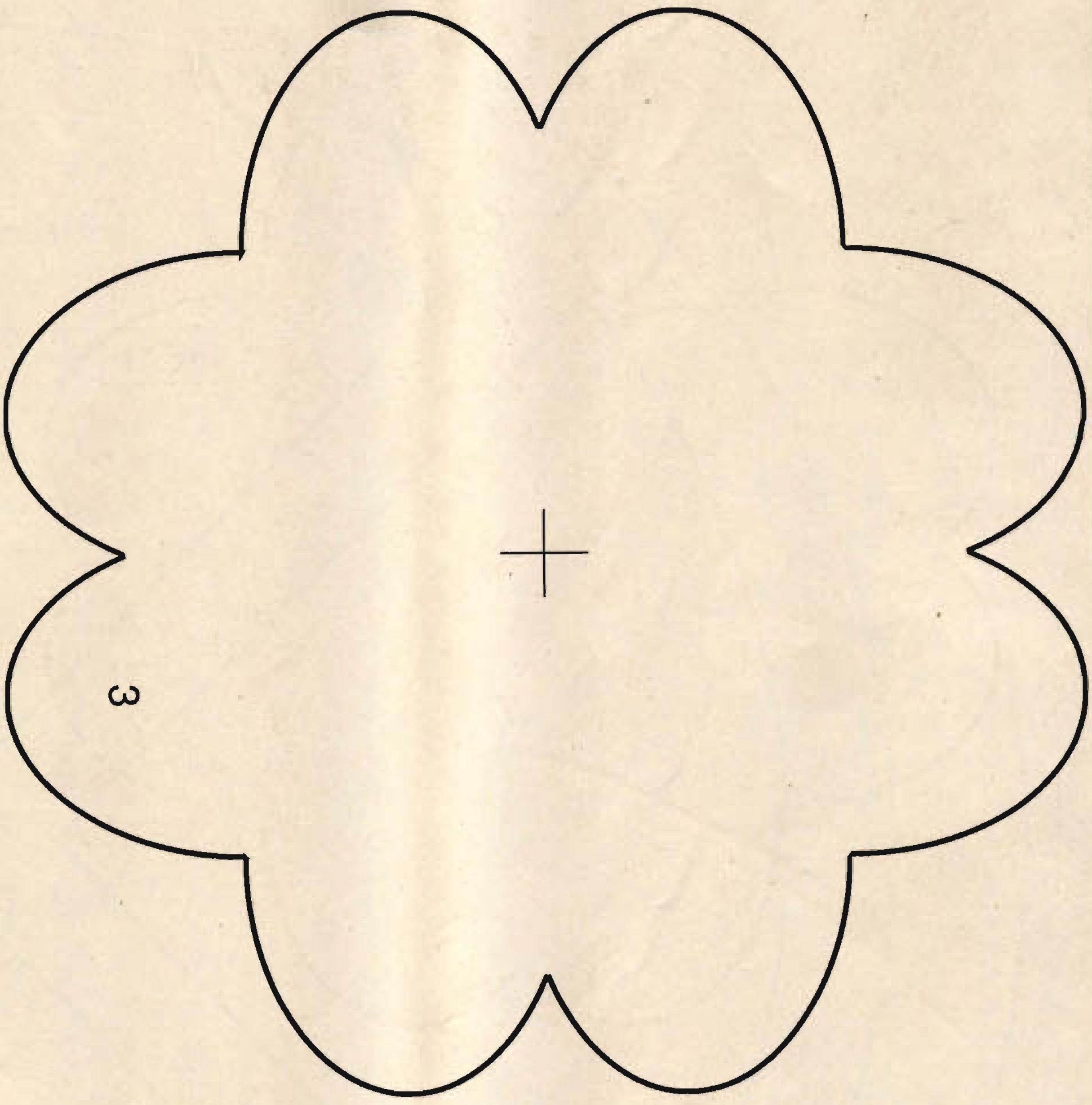
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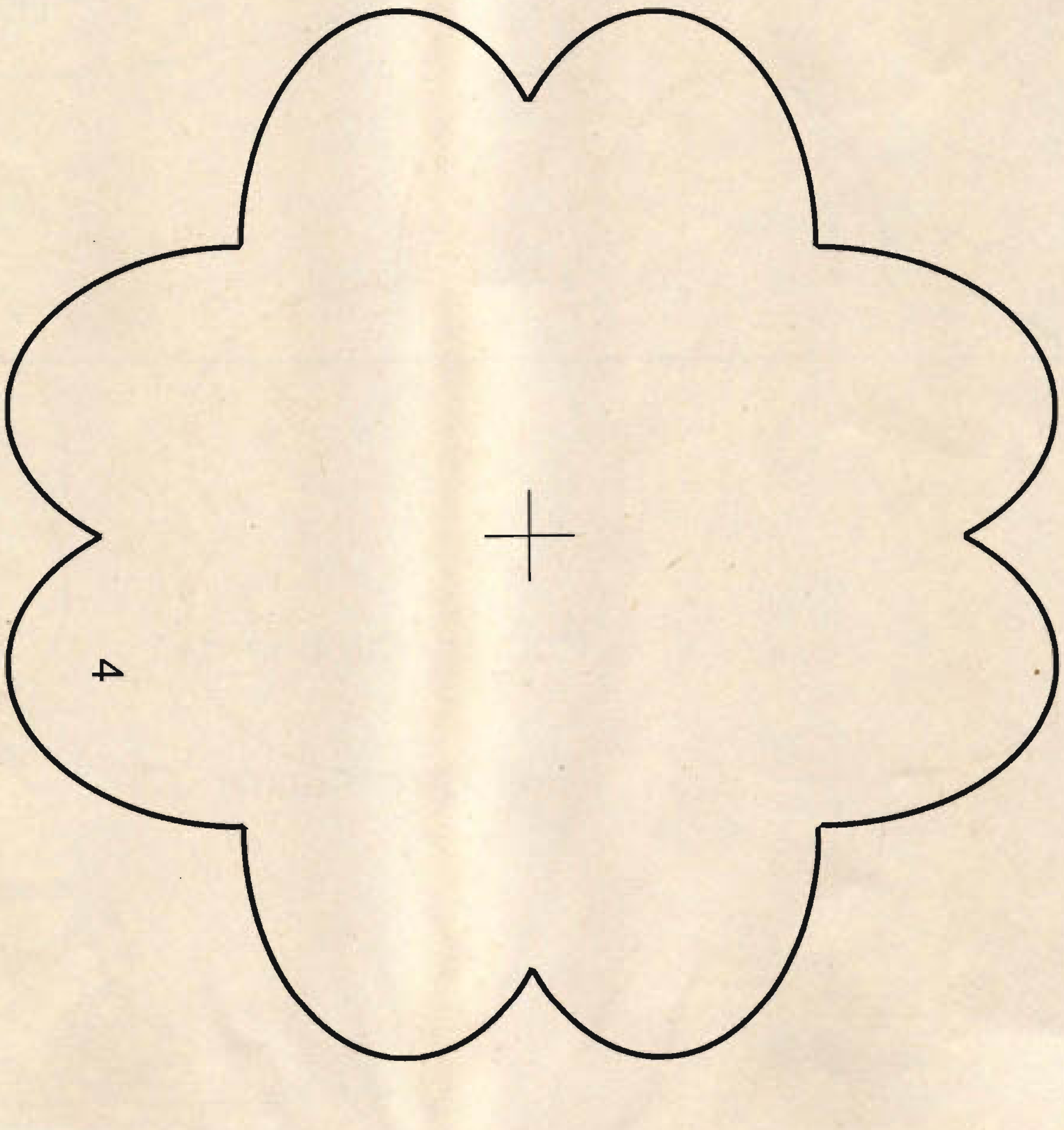
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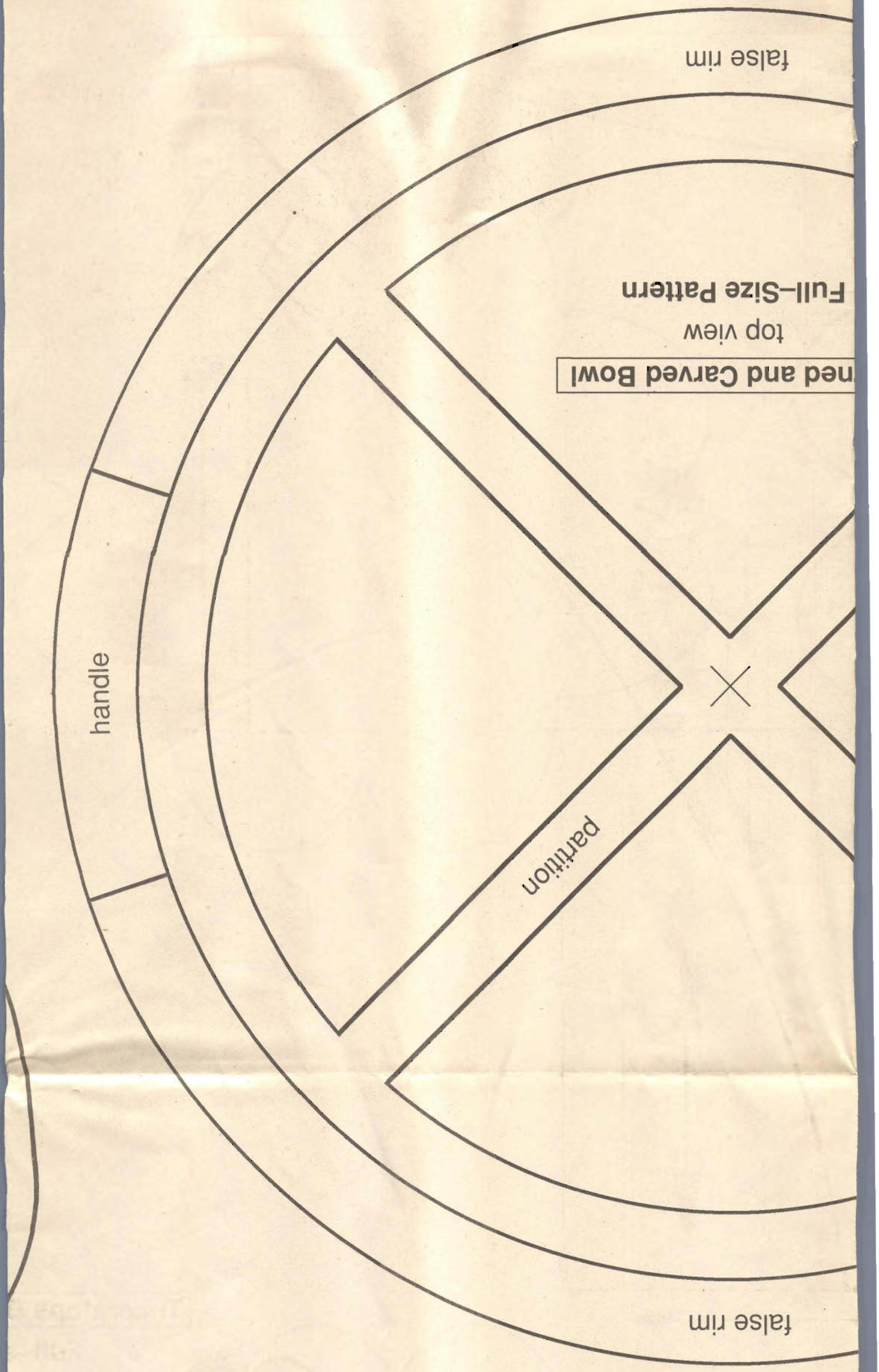
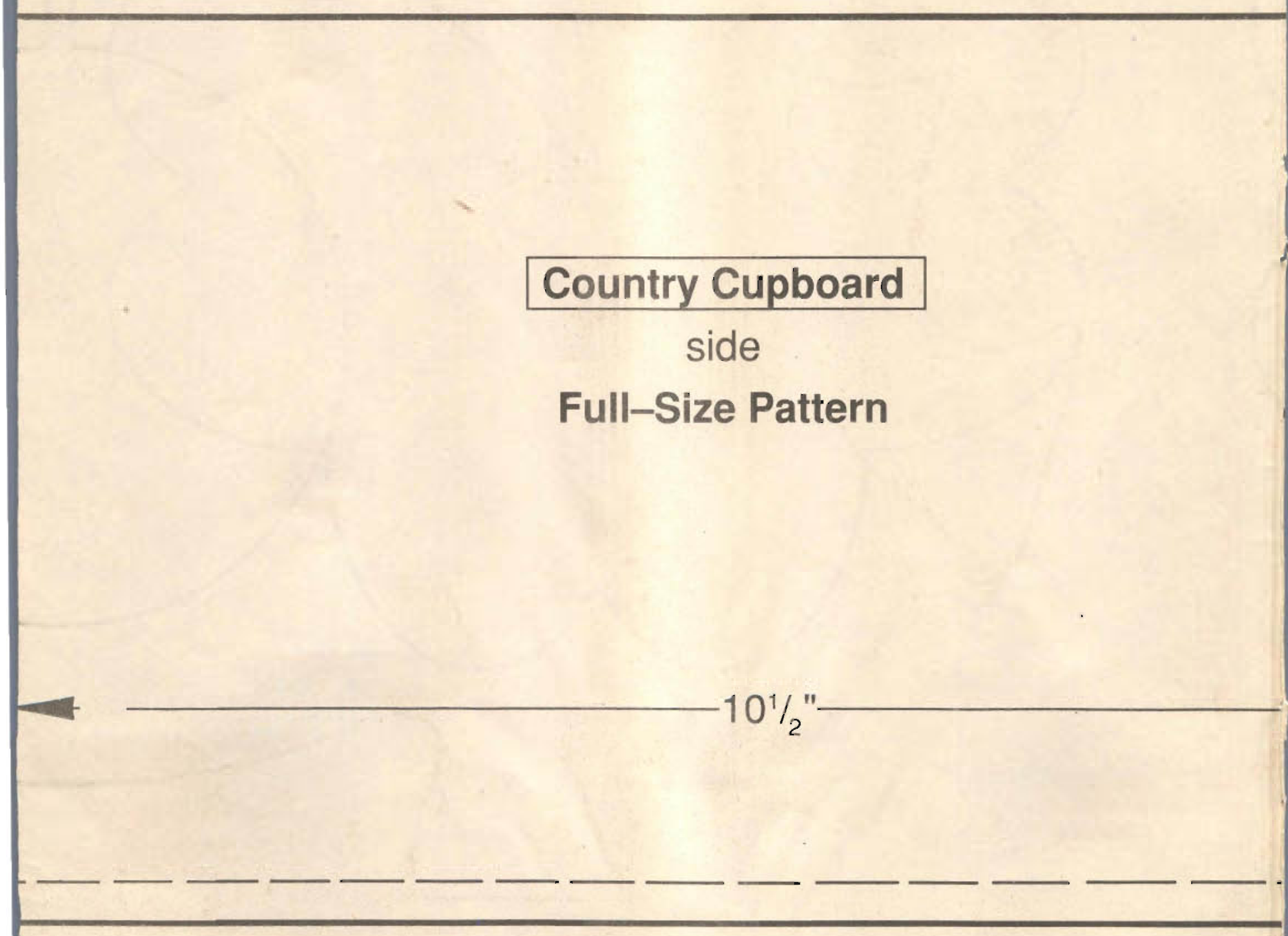
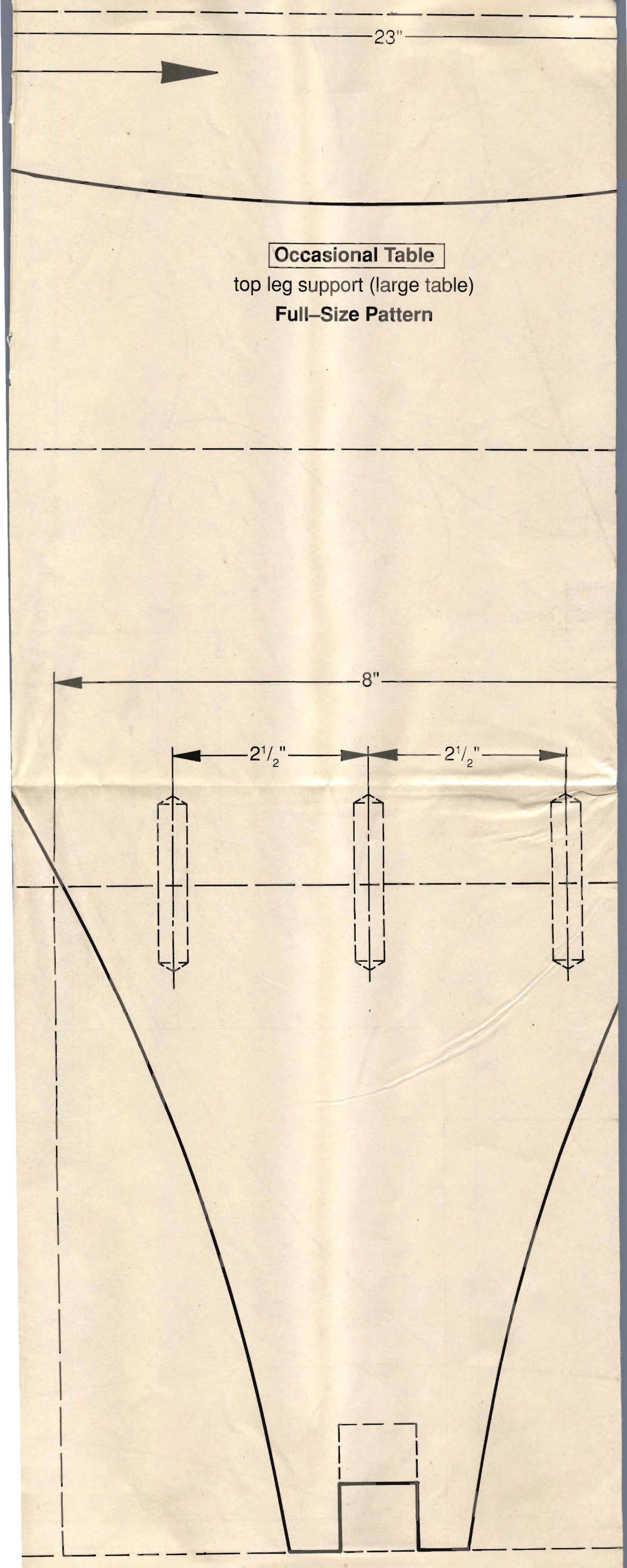


Country Cupboard
side
Full–Size Pattern





Occasional Table

top leg support (large table)

Full–Size Pattern

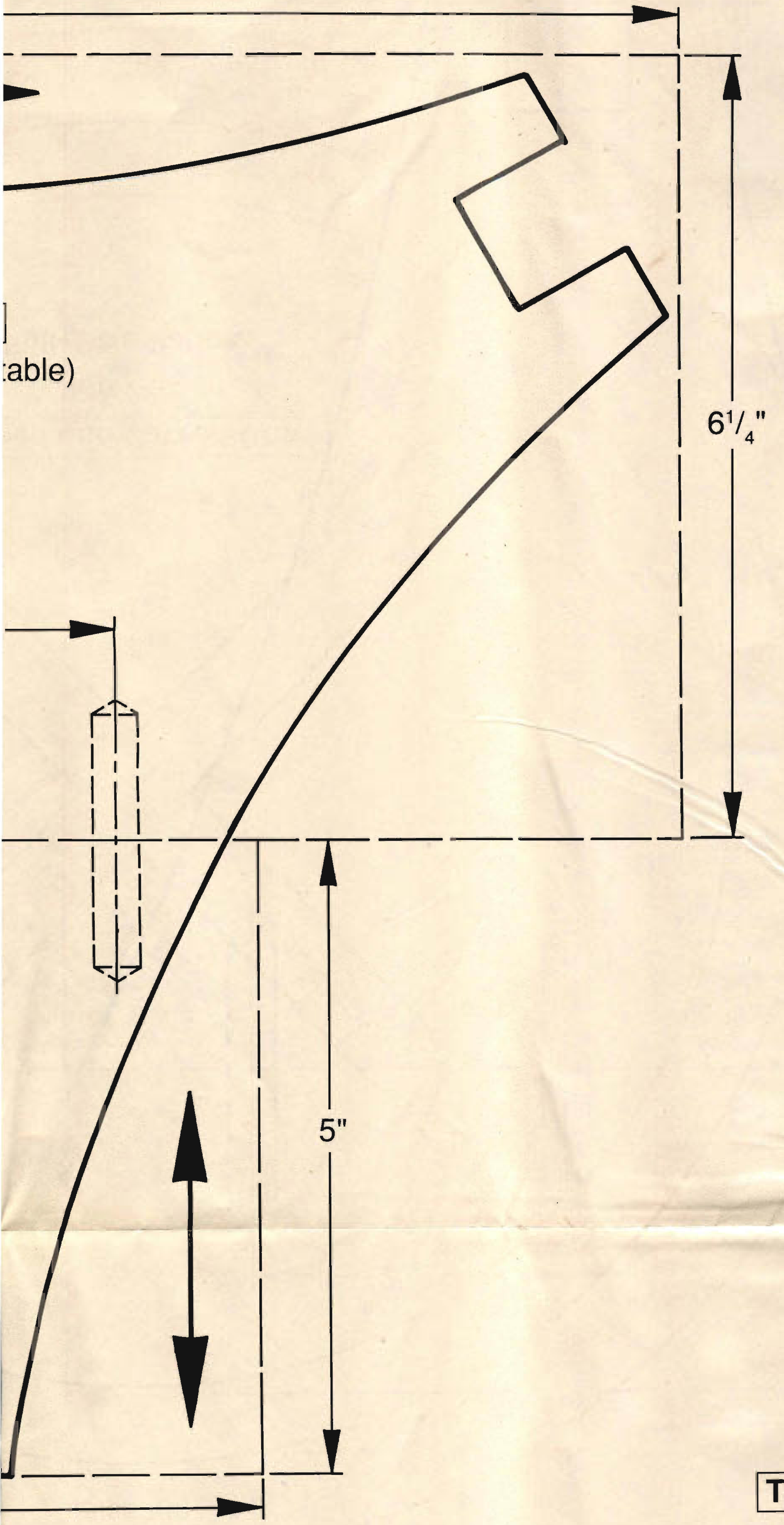
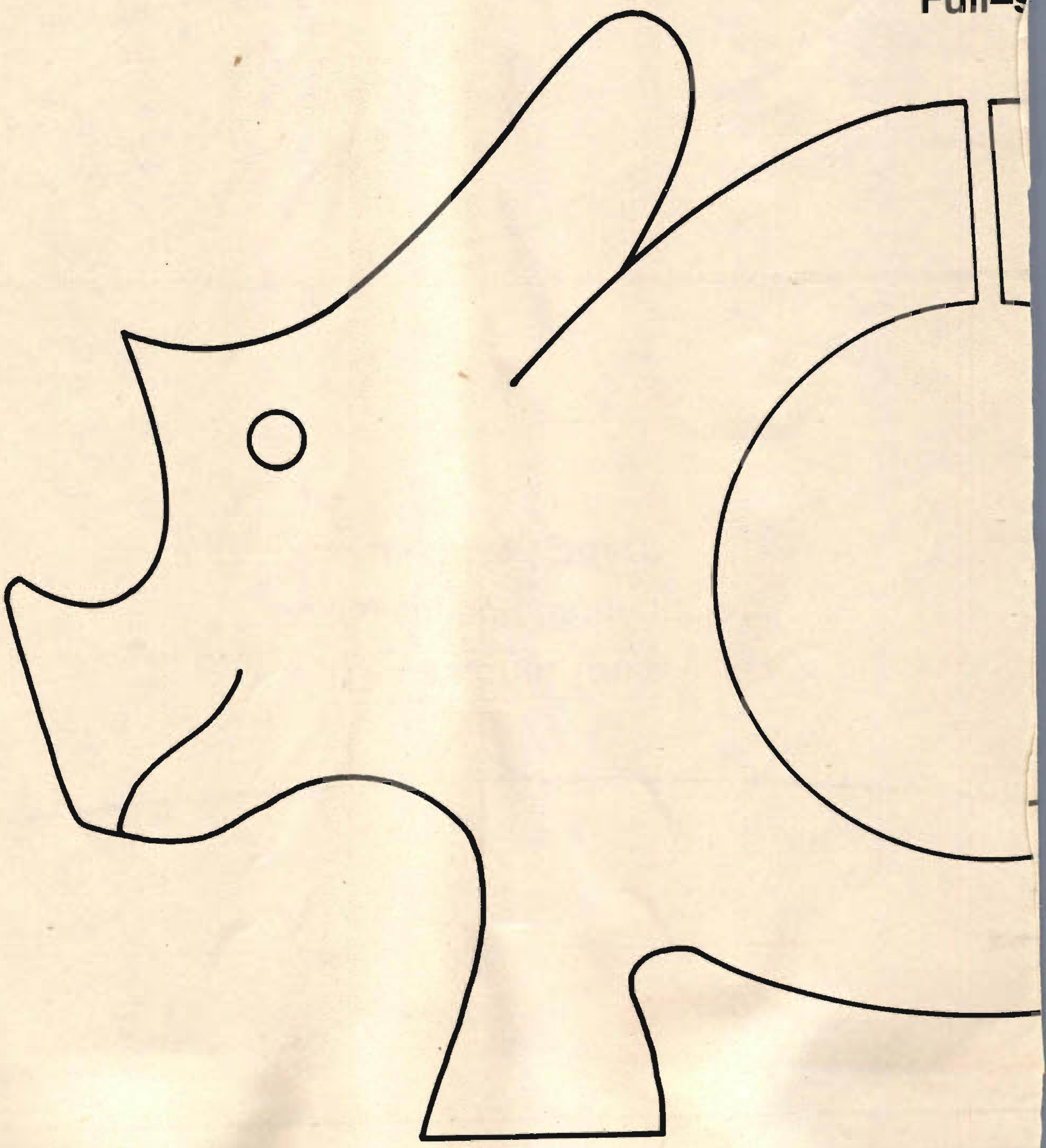


table)

Triceratops B

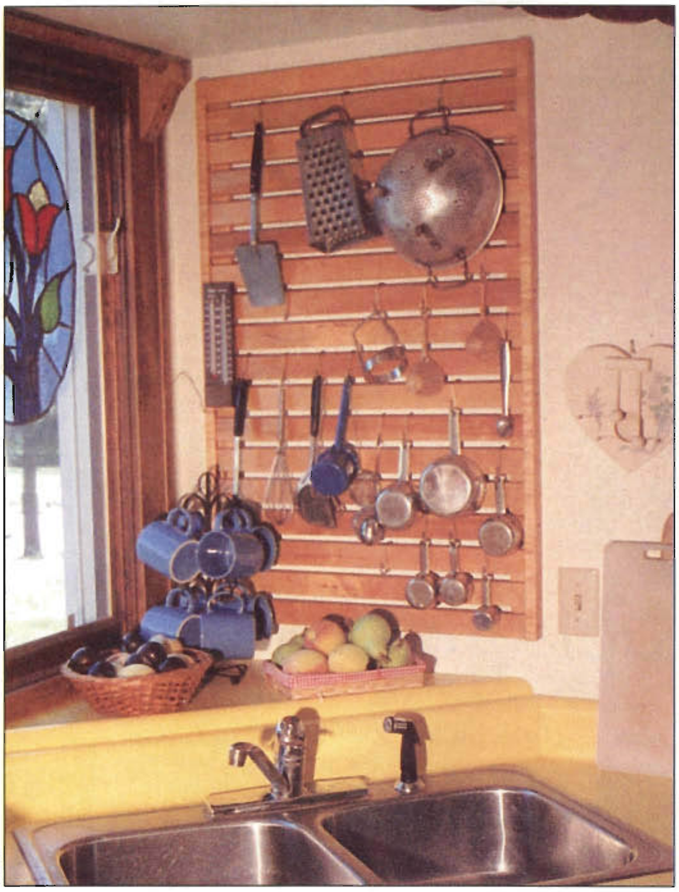
Full-s



A Practical Kitchen Storage Rack

by Hugh Foster

Every kitchen has a small collection of necessary utensils that are used so often that putting them away seems to be almost a crime against efficiency. Here's a project that helps to keep such utensils readily at hand, while providing a decorative accent to almost any working kitchen. I've seen similar items at outrageous prices in the "gourmet" departments of fancy department stores, but this is something that should be custom–made for your kitchen rather than being bought precut. I can't really tell you how big your rack should be, or where in the kitchen you should put it, but here is how I planned and built the rack for my kitchen.


author

The first consideration is position. Where in the kitchen is there room for such a rack, and where will it do the most good? In my kitchen, the best spot was right over the kitchen sink. The countertop extends more than 20" behind the sink, and much of the wall space next to the window above it would be simply "dead" if we hadn't filled it in this way. The right size for the rack in that spot was 24 1/2" wide by 38 1/2" high.

Start by cutting out the slats you'll need. My rack required 18 horizontal slats 5/8" X 1 1/2" X 24" and four vertical slats 5/8" X 1 1/2" X 38 1/2". Actually, these dimensions were influenced by "chance" in my shop. At the time, I had been doing lots of work with 2" maple stock, and there were enough rippings that I was able to make the rack for the cost of the fasteners and finishing material. You may find it advantageous to plan your rack around the leftovers in your own shop.

Before I began assembly, I rounded the corners of the good face of each horizontal slat with a 1/8" round–over bit and sanded them smooth.

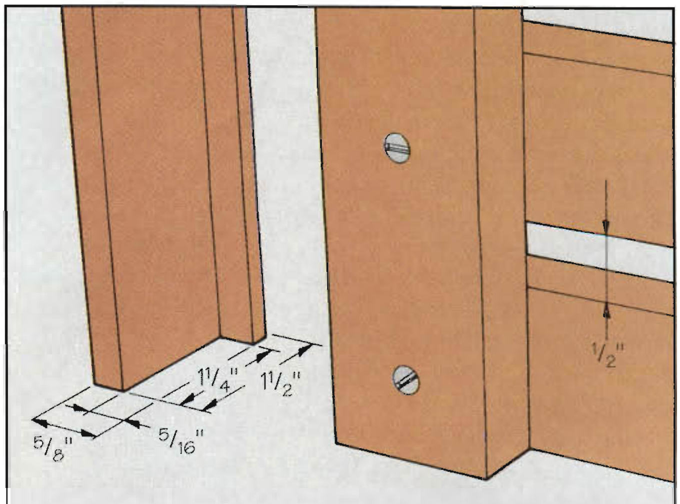
Two of the vertical slats are used as the backing pieces. Attach the backing slats across the ends of the horizontal slats using flat head wood screws driven in from the back. Space the slats 1/2" apart, and use a single screw at each joint. Predrilling with a countersink bit speeds the process and makes the results neater.

Use the two remaining slats as trim pieces to cover the ends of the horizontal slats. Cut a 1/4" X 1 1/4" rabbet on one face of these slats, after rounding the corners on the front edge. Sand the pieces, and attach them to the backing slats with three surface–mounted, round head brass screws in each.

Use a finish that will stand up to having wet utensils hung on it after washing. I used a couple of coats of spar varnish when I made mine several years ago. Today I might be inclined to use Hydrocoat® polyurethane, for it is much easier to apply and it dries more quickly and more forgivingly.

Mount the unit to the wall using 2" screws or mollies driven through the backing slats. I was able to buy my utensil hooks in one of those gourmet shops, but you could fashion your own from clothes hanger wire bent like an "S" with square bends where it hooks on the slats.

We've gotten lots of use from this rack and lots of compliments about it. After yours is in place, you'll wonder how you got along without it. PW

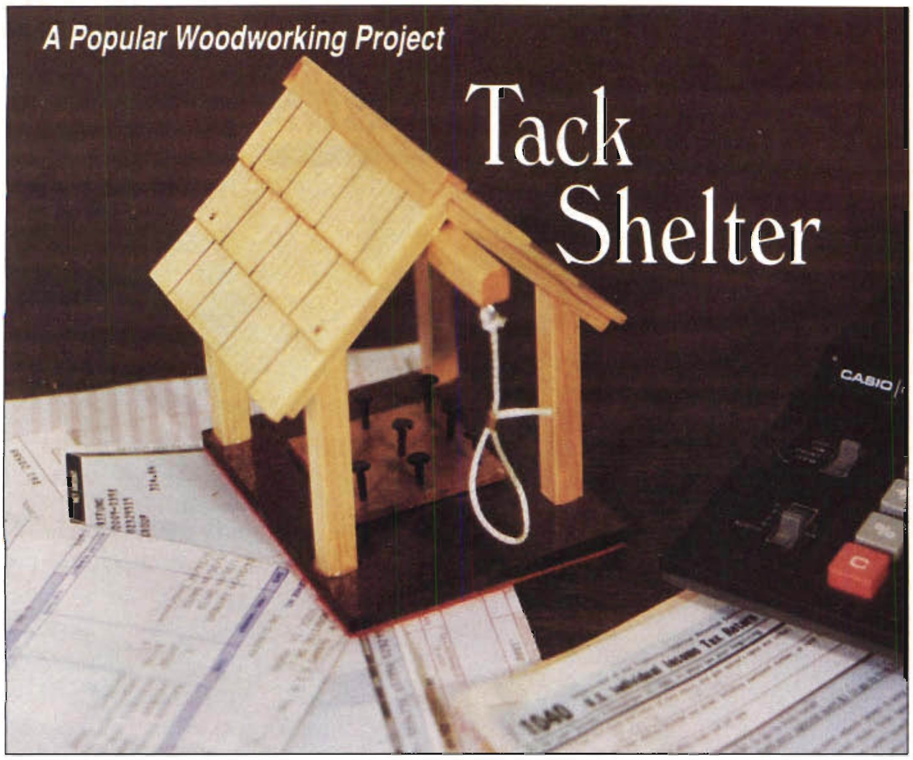


Rear View of Assembly

Tom Larson

***Hugh Foster** is an English teacher and writer who designs and builds furniture in Manitowoc, Wisconsin.*

A Popular Woodworking Project



Tack Shelter With a Loophole

by Howard V. French

It isn't often that an attractive tack shelter with a perfectly legal loophole becomes available to just about anyone. This is such a time, and you are invited—even encouraged—to take advantage of an unusual opportunity.

Your friends, relatives and your friendly neighborhood CPA will sincerely appreciate being made beneficiaries of your fortuitous discovery. You only have to follow these comparatively simple instructions to become a phantasmal philanthropist.

First, construct two roof sections (A) for each tack shelter desired. This is the most difficult component to make, but with the shingle mill jig shown in *Jig Journal* at right, it's not too much trouble. Cut the roof pieces to the dimensions given in the Cutting List, observing the direction of the grain. I resaw yellow pine and dress it to a finished thickness of $^5/_{16}$" . Mill the shingle courses as described in *Jig Journal*; then miter the top (peak) edge at 45°.

Attach an auxiliary board to the rip fence, and set the blade and fence to cut a $^1/_8$" X $^1/_8$" rabbet around the gable ends and the eves—the remaining three edges of the pieces. Scribe simulated shingle divisions along each of the three courses using a ball point pen.

Match roof sections in pairs to form a 90° roof, using a squared block of scrap material as an alignment jig (wrap the block with wax paper to keep it from becoming incorporated into your tack shelter). Apply wood glue to the mating surfaces and secure them and the square block with rubber bands while Elmer does his thing.

Cut some $^5/_{16}$" X $^5/_{16}$" timber for the ridgepole (B) and the corner posts (C). Sand off two adjacent corners of the ridgepole so as to leave $^1/_{16}$" flats at 45°. Apply glue to these flats where the ridgepole is to contact the undersides of the roof sections, and press it in place. Cut two cap strips (D) and glue them in place as shown in Figure 1.

Cut the base (E) to size from $^1/_4$" Masonite®. Locate the centers for the corner posts as shown in Figure 2 to position the posts $^1/_8$" from the edges of the base. Chuck a #18 X 1" wire brad in your drill and use it to drill through these centers for the four corner posts. Insert wire brads from beneath the base, apply glue to the bottoms of the posts, and press each in place securely and squarely.

Cut out a 2" X 2" square from $^1/_8$" Masonite® for the tack base (F) and lay out the pattern for the tacks as shown in Figure 2. Place the base piece onto a scrap of wood, *and drive* the tacks through the base far enough so that you can then turn it over and clinch their points. Glue the tack base to the shelter base.

Once the roof assembly has set up securely, locate a screw eye in the end of the ridgepole on the underside of the part that extends past the roof. Tie a piece of nylon cord through the eye and form a suitable loop on the other end. Slip on a short piece of brass tubing and affix it with

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***Howard V. French** lives in Abilene, Texas where he spends his time dreaming up woodworking project ideas.*

Jig Journal

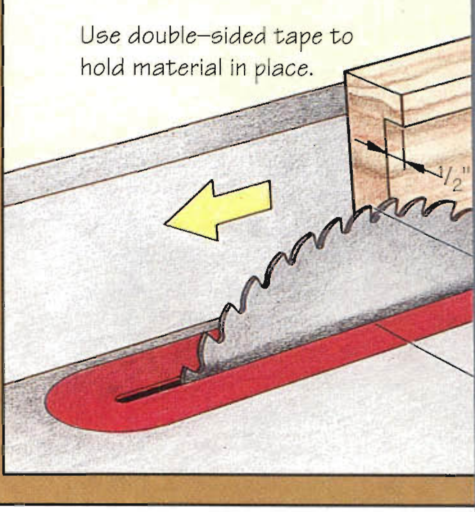
A Shingl

by Howard V. French

This jig can be used for making roofs for doll houses, bird houses or for any model buildings you might design. It's just a carrier block that guides the stock past the tilted blade.

Start with a scrap of 2 X 4 that is an inch or two longer than your roof sections. Using a straight bit in a router, cut a $^1/_2$" deep recess in the 2 X 4 to accept the roof stock as shown in the illustration above. You will need to make several passes with the router, removing small amounts of material at a time until you reach the $^1/_2$" depth. It would also be helpful to have another scrap of 2 X 4 next to the block to support the router base as you remove material. Square out the corner with a chisel so the roof stock can nest properly in the carrier. Use double–sided carpet tape

Roof Carrier Block

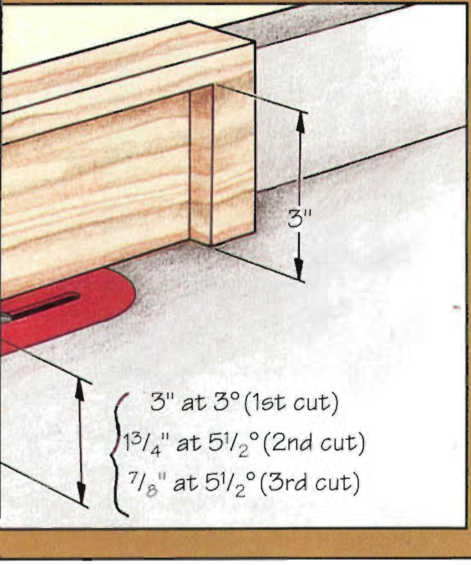

Use double–sided tape to hold material in place.

Milling Jig

to secure the stock in the jig.

To use the jig, set your table saw blade to 3° out of square and raise it to 3" high. Place the carrier block against the fence with the roof stock in place, and position the fence so that the top edge of the blade just cuts $^{1}/_{16}$" into the roof at the top. Pass the workpiece and the jig through the blade and remove it at the other side; don't try to pull them back through. Be sure to use push sticks to hold the jig firm against the fence and to push it through.

Next, set the saw for $5^{1}/_{2}$° out of square and a $1^{3}/_{4}$" depth of cut. Check the fence position so that the blade cuts only $^{1}/_{16}$" into the material again, and make the next pass. Repeat this process for the third pass with the blade set at $^{7}/_{8}$" depth. **PW**


3"
3" at 3° (1st cut)
$1^{3}/_{4}$" at $5^{1}/_{2}$° (2nd cut)
$^{7}/_{8}$" at $5^{1}/_{2}$° (3rd cut)

a drop of glue.

Finally, hoist the prefabricated roof assembly into place and align it with the ends of the corner posts. Drill through the roof sections and into the posts using the brad for a bit again. Then put a drop of glue on the ends of the post and secure the roof in place while you push the brads home.

Apply whatever finish you choose; I used a clear varnish. Glue a felt pad to the bottom of the base. You now have a tack shelter with a loophole that is entirely legal in all fifty states and the District of Columbia. Well worth your time, effort and materials! **PW**

Figure 1. Assembly

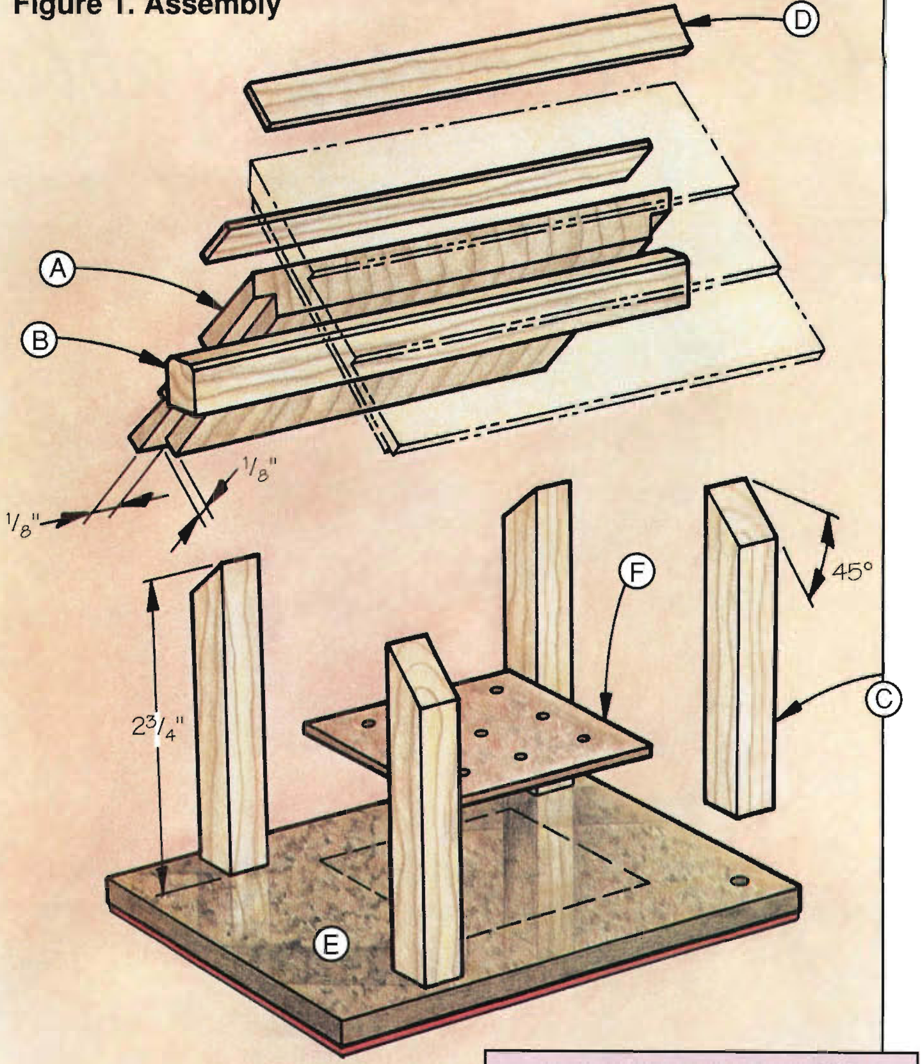
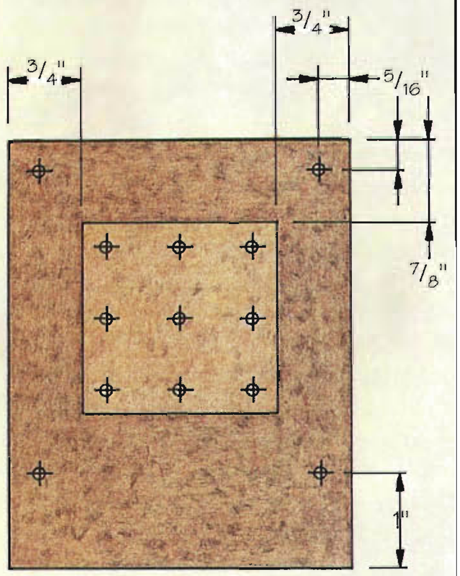


Figure 2. Base Layout



Illustrations by Tom Larson

Tack Shelter With a Loophole

Cutting List

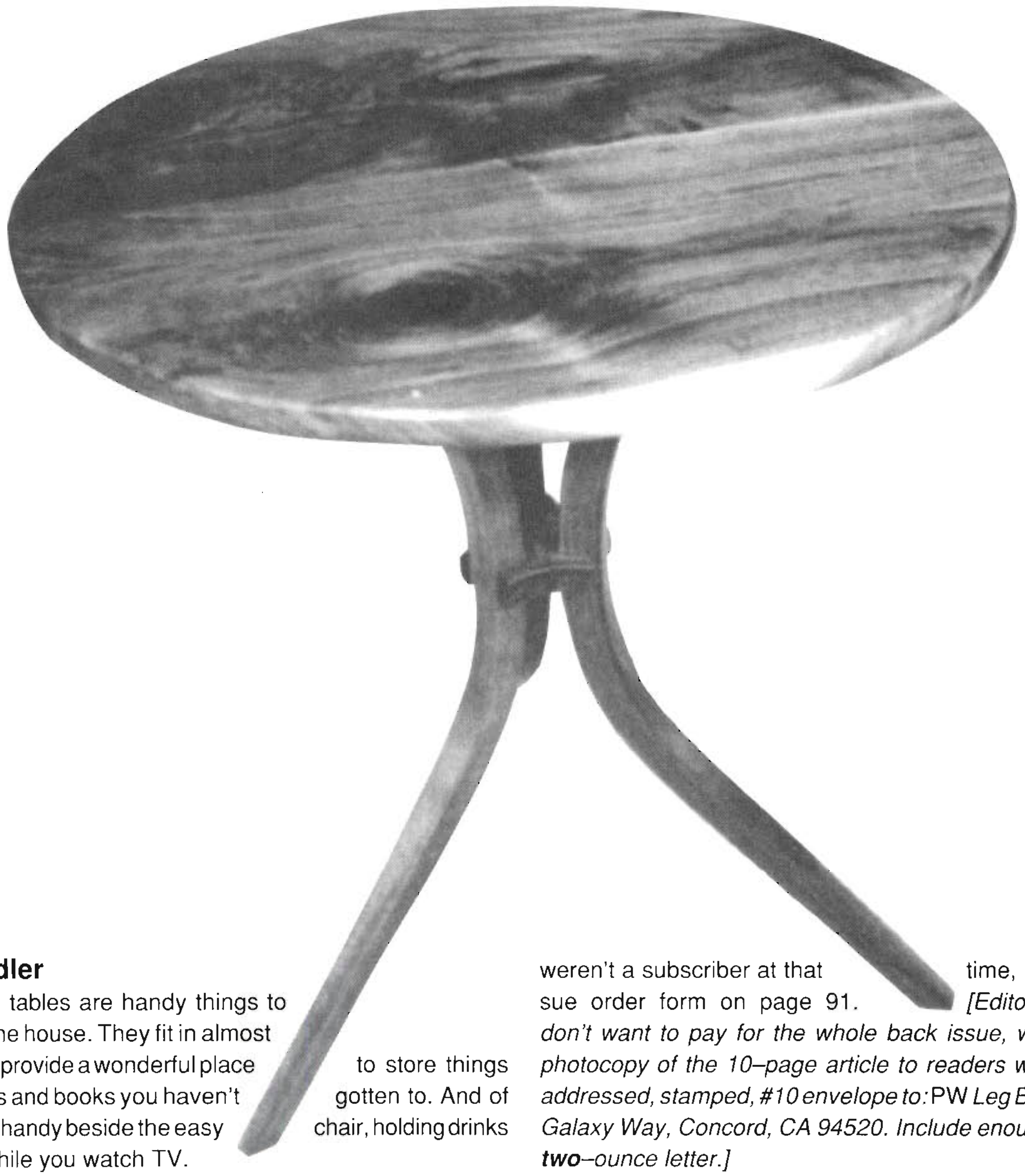
Qty	Part	Finished Size T	Finished Size W	Finished Size L	Piece
2	A	$^{5}/_{16}$"	3"	$3^{3}/_{4}$"	roof sections
1	B	$^{5}/_{16}$"	$^{5}/_{16}$"	$4^{3}/_{4}$"	ridgepole
4	C	$^{5}/_{16}$"	$^{5}/_{16}$"	$2^{3}/_{4}$"	corner posts
2	D	$^{1}/_{16}$"	$^{5}/_{16}$"	$3^{3}/_{4}$"	cap strips
1	E	$^{1}/_{4}$"	$3^{1}/_{2}$"	$4^{1}/_{2}$"	base
1	F	$^{1}/_{8}$"	2"	2"	tack base

Supplies

8	#18 X 1" wire brads
9	#10 X 5/8" tacks
1	hook eye
	nylon cord
	1/8" brass tubing
	felt

A Popular Woodworking Poject

The Occasional Table



by Ken Sadler

Occasional tables are handy things to have around the house. They fit in almost anywhere and provide a wonderful place to store things like magazines and books you haven't gotten to. And of course they're handy beside the easy chair, holding drinks and snacks while you watch TV.

Here are two small tables based on the same design. In fact, they both use the same legs, only the leg supports and the tops are different. Both are the same height but one is 20"–24" in diameter and the other is 30"–36" in diameter. I have specified a range in diameter for each to allow flexibility in fitting to your individual circumstances.

The legs are made by gluing up a laminated blank in a jig. It is the same jig that was used to make the legs for the writing table in the July 1990 issue of this magazine ("To Write a Letter," page 64, *PW* #55). At that time I told you that the jig was designed to make two styles of legs. This is the other style. If you built the writing desk then you will have the jig, or if you saved the issue, you can make it now, without further ado. If you didn't save it, or weren't a subscriber at that time, see the back issue order form on page 91. *[Editor's Note: If you don't want to pay for the whole back issue, we'll send a free photocopy of the 10–page article to readers who send a self–addressed, stamped, #10 envelope to:* PW *Leg Bending Jig, 1320 Galaxy Way, Concord, CA 94520. Include enough postage for a* ***two****–ounce letter.]*

Making the Legs

Right now I'm going to assume that you have the jig on your workbench and are ready to get on with the project. This leg has a smaller cross–section and makes the full 90° curve rather than the 45° bend of the writing table (see Figure 1). As before, the first step is to cut the laminations that make up the blank. The finished height of the leg in this project is $23^{1}/_{4}$", so the laminates will need to be approximately 31" long. Precision is not required here, but it is on the thickness of the laminations. The finished cross section of the leg is 1" X 1". With the sharpness of the curve involved, the thickest lamination you should use is $^{1}/_{8}$". Eight of them will do the job. Since it is impossible to keep the laminations in line during the bending process, make them at least $1^{3}/_{8}$" wide.

Ken Sadler *is a retired furnituremaker in Portland, Oregon.*

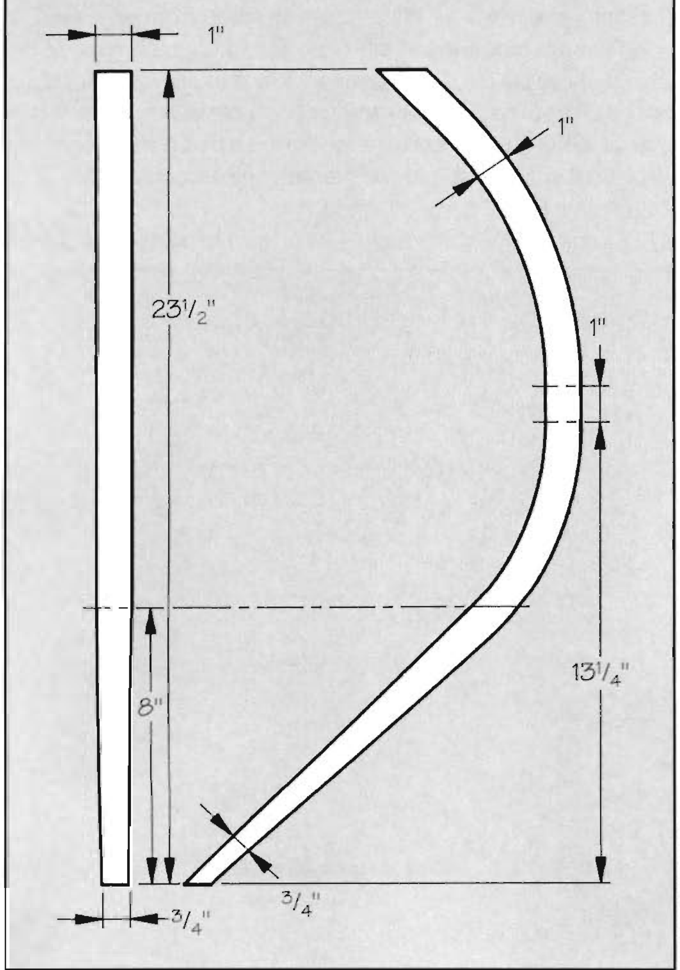
Start with three boards that are $1^{3}/_{8}$" X $2^{1}/_{2}$" X $31^{1}/_{2}$". Joint one $1^{3}/_{8}$" face and one $2^{1}/_{4}$" face square with each other. When choosing the material for these boards, it is best to use pretty straight–grained wood. Some figure will be all right in the straight sections but not in the area of the curve. Use a band saw to do the resawing. Set your fence to $^{1}/_{8}$" and start ripping with the $1^{3}/_{8}$" face against the fence. As you rip each piece, lay it aside and then lay the next one on top in the exact order in which you cut them. When you have eight, bind them together with masking tape and mark them "leg 1, leg 2 and leg 3." Don't try to smooth up the mating faces, just leave 'em alone. Each board will make one leg. You should have one smooth face on each set. This face will go against the jig blocks during the gluing process.

It would be a good idea to go through a dry run of the procedure for gluing up the legs, just as I described in the previous article. Position your C–clamps in the order shown in Figure 2. If everything goes smoothly, you're ready to do it with glue.

You must line the jig with wax paper, or you'll never get the blank out. Just see that the face of the jig blocks and the entire flat surface in front of the blocks is covered with the wax paper turned under the front and side edges and taped to the bottom.

When applying the glue, use a stiff 2" brush sideways (I sort of scrub it on), and cover both surfaces of the mating faces entirely. Be sure and keep them in order. Line up the ends and sides (they won't stay that way, but they should be so at the start) put them in the jig in the proper position and proceed as during the dry run.

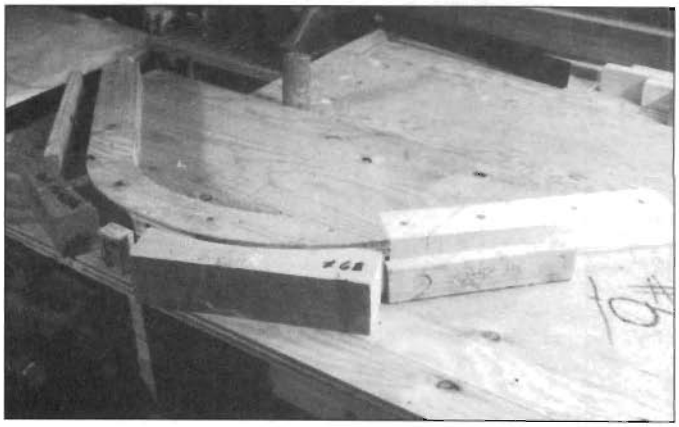
Figure 1. The Leg Dimensions



illustrations by Tom Larson

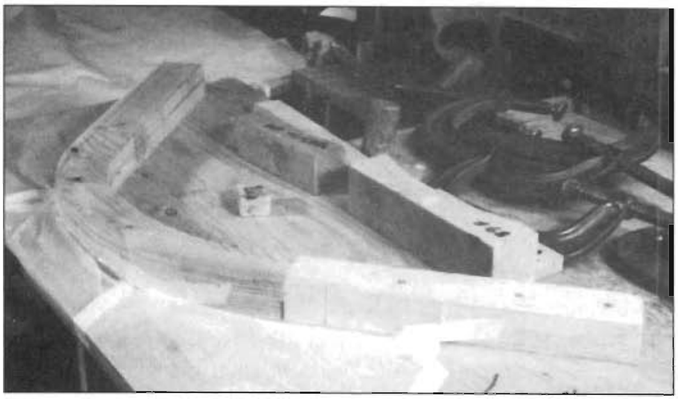
After about six hours you can take the blank out of the jig. You can't do any work on it at this time but you can glue up another set. When the blank comes out of the jig, the wax paper will stick to the underside and there will be wet glue between the paper and the blank. Peel the paper away and use an old putty knife to scrape off as much of the wet glue as you can. It will speed the final drying and save work later on.

When the last leg blank has been out of the jig for 24 hours, the



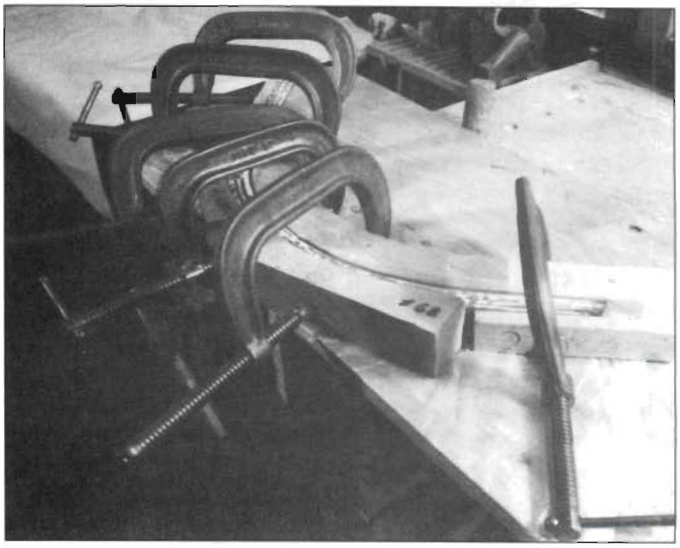
Use the leg bending jig from PW *#55, but remove the block for making the 45° bend.*

Cover the jig with wax paper to keep the laminated blank from becoming glued in place.



photos by the author

Clamp the blank in the jig, positioning the clamps in the order shown in Figure 2.



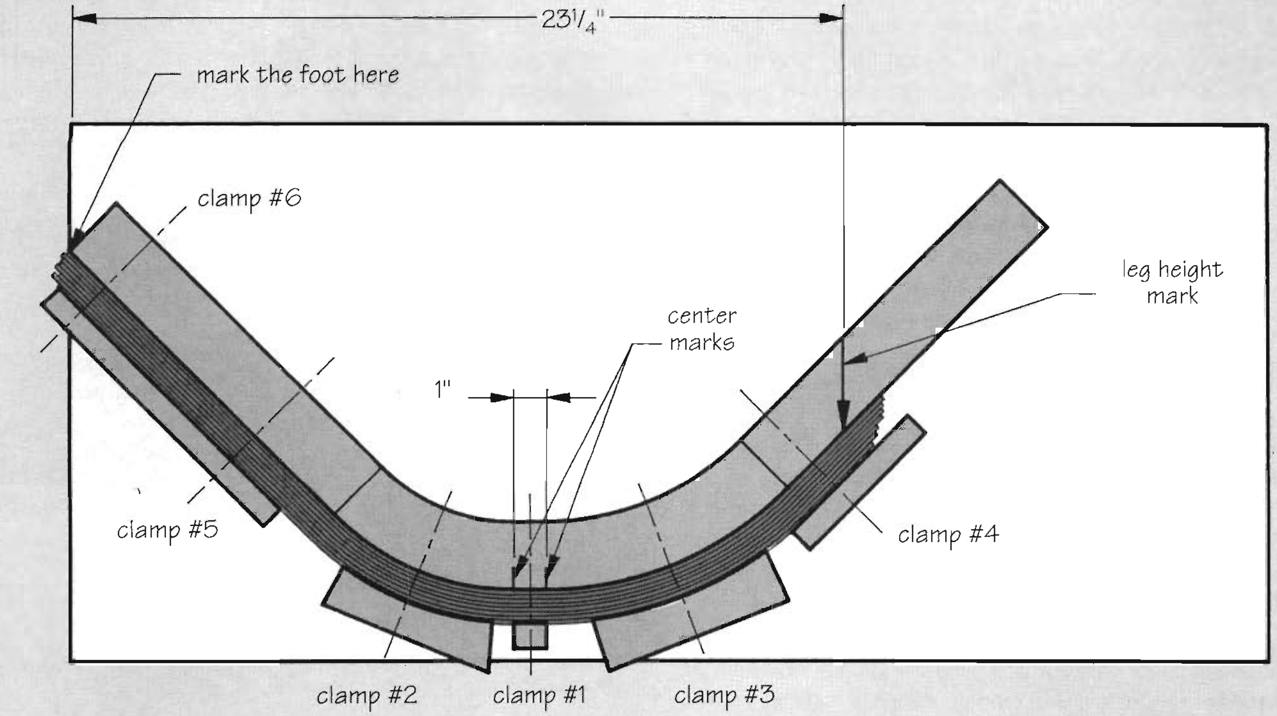


Figure 2. The Leg Bending Jig

finishing of the legs can begin. The first step is to joint one edge square with the back of the blank (the face that was out in the jig). With the jointing operation, don't go any deeper than is necessary to get a smooth flat surface—you only have 3/8" leeway to play with. Once you have jointed all the blanks, then rip them to 1" plus 1/32" if you've got it. That thirty–second of an inch will allow a final pass through the jointer on the ripped face.

Having cleared away all the wax paper and masking tape, put one blank back in the jig so that it fits the curve snugly. Mark the bottom of the foot at the left end of the jig and the top of the leg at the point shown in Figure 2. Cut both ends at a 45° angle to the face. Mark the center section on this first leg from the jig. Mark the other two blanks from this one and make the cuts. The accurate marking of the center section on all three legs is important, as you will discover later.

The next step is tapering the foot. The single taper is on the inside of the curve and begins at the bottom of it. The double taper on the sides begins at about the same point (Figure 1 shows 8"; this is approximate). Rough cut these tapers on the band saw and finish them with a spokeshave. Blend the beginning of the taper so that it's a smooth transition and not an abrupt change. Don't round any corners at this time.

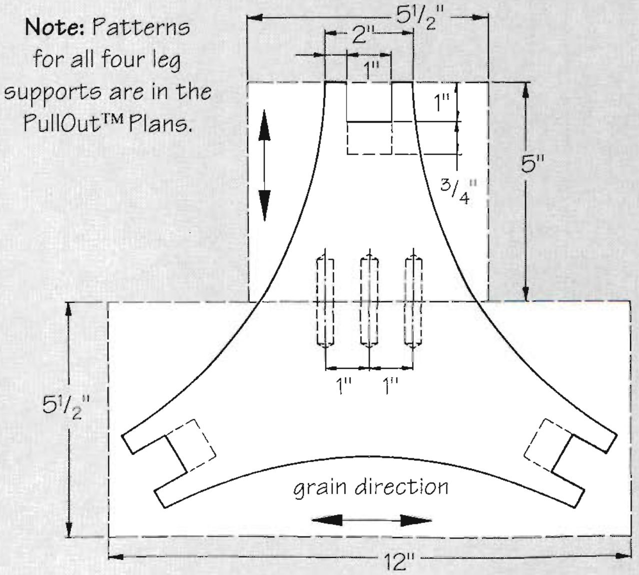
The Rest of the Assembly

The next step is to make the supports which hold the legs together and make up the base assembly. Each table has two different leg supports, and they are sized differently for the two table sizes. Full–size patterns are provided in the PullOut™ Plans section.

The blanks for the supports are shown in the PullOut™ Plans as dotted lines around the finished support (see Figure 3). It is important that they be made as shown and that the templates be placed in the positions shown. Pay particular attention to the grain direction. The blank for the smallest is made from one piece of wood but the others are made from two, and in the case of the largest, three pieces. The reason for this is to prevent the side of one notch from being cross–grain and therefore very weak. In the case of the largest support, I made the main part out of two pieces because it is easier to get two pieces of hardwood that are 5½" wide than it is one piece 11" wide.

The notches must fit the legs snugly, but not tightly. You should

Figure 3. Top Leg Support for Small Table


Note: Patterns for all four leg supports are in the PullOut™ Plans.
5½"
2"
1"
1"
5"
¾"
1"
1"
5½"
grain direction
12"

Illustrations by Tom Larson

be able to push them into place with gentle pressure, but the parts should tend to stay put when placed. Regard the notch dimensions shown in the pattern as a starting point. If your legs have come out slightly wider than 1", cut the notches to 1", and lightly plane the legs till they fit properly. If, however, your legs have come out less than 1" wide, cut the notches to fit the legs.

The notches in the top supports must be cut back on the underside at a 45° angle to fit against the back of the leg. Cut the through part of the notch and fit it to the leg, then turn the support over and mark the extent of the angle cut. Now, using a dovetail saw, cut the sides of the angled section and then carefully remove the waste with a chisel creating a "ramp." I suggest you cut the notches before you cut the support to shape. It will be much easier to hold while working on it. Drill a $^{3}/_{16}$" hole in each arm of this piece for attaching the top. Locate the hole just behind the notch but not in line with it, so the legs won't interfere with the screwdriver. Counterbore the holes, on the underside, for a #8 flat head wood screw.

Having completed all the parts of the base, it is time to assemble it dry. Set the top leg support bottom–side–up on a flat, level surface. Place the legs in the support notches so that they touch the back of the notch. Position the middle leg support at the marks on the legs. The backs of the legs should fit firmly against the backs of these notches also. Using a 24" steel scale, measure the distance from the flat surface to the foot of each leg. This measurement must be equal for all three legs. If they are not, adjust the vertical position of the legs as a group until they are. If you can't make the distances equal, first check the notches in the middle support; one may not have been cut deep enough, or possibly too deep. Cut it deeper or use a shim. If that doesn't fix it, check the notches in the top support. If they still won't match, take the assembly apart and measure the length of the legs against each other, one may be longer or shorter than the others. When assembled, the distances must be equal or the table will not be level.

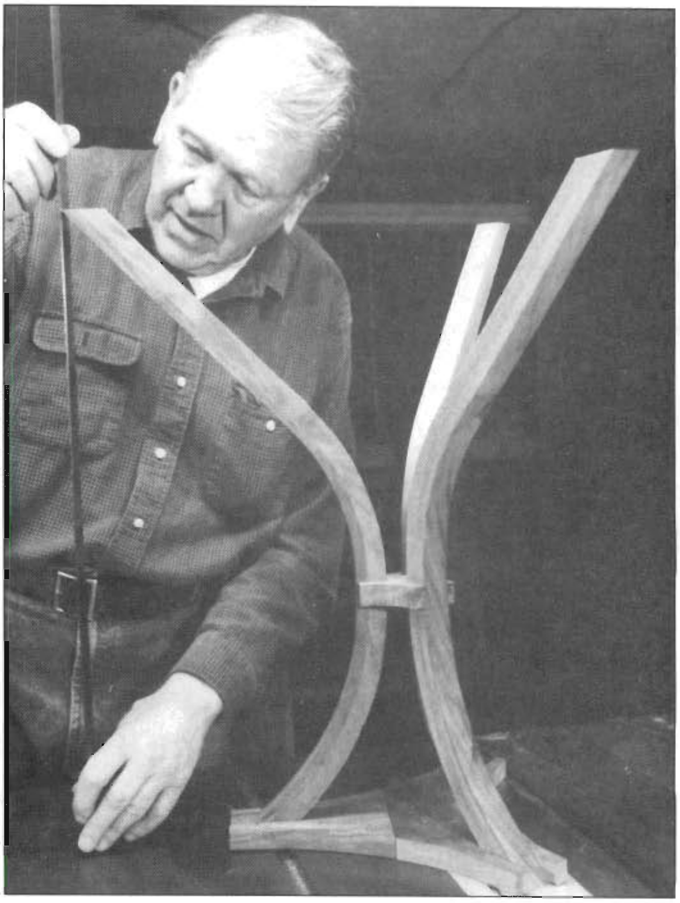
It may take some time but if you've made the parts correctly, they will go together right. When you have it right, mark all the parts against each other so that you can get them back the same way, and take the assembly apart. Put glue in the notches, not on the legs, and use it sparingly. Put the assembly together again on the marks, and recheck the leg distances from the working surface. Let the glue dry for 24 hours before moving it.

While the glue is drying, you can make the top. This is a simple matter of gluing up a panel large enough to accommodate the diameter you're going to use, and bandsawing the circle. Smooth up the edge with a spokeshave. Put a small ($^{1}/_{8}$") radius on the top and bottom edges. Some people do this with a router; however, I've found that unless the cutter is very sharp, it has a tendency to tear in the areas of cross grain. This is difficult to sand out without spoiling the radius. I do the job by hand, with a spokeshave. Take it slow and keep your eye on the radius you're making and it will come out better than with the router.

Take the base assembly and saw off the end of the legs that protrude beyond the support arms. Now you can mount the base to the top, and the table is done except for finishing. As before, I'll leave the finishing up to you. However, I suggest no stain, and several coats of Formby's Tung Oil Finish, low gloss, hand rubbed on. It will give just the right amount of sheen for this style of furniture. PW

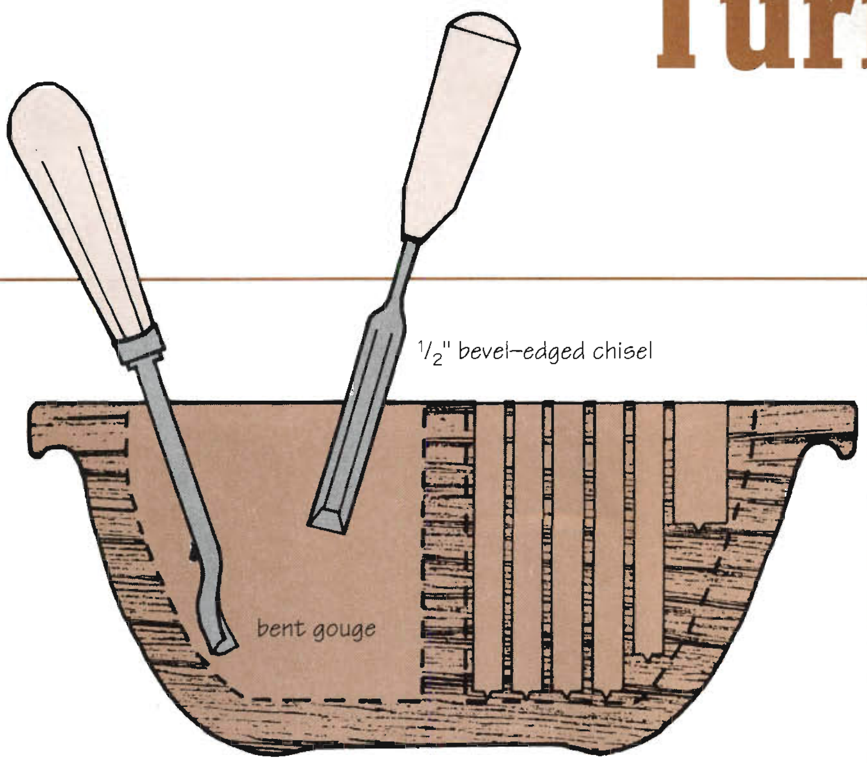
Use a hand saw to make the sloping cuts that define the "ramp" in the notches of the top leg support.

Set the assembly upside–down on a flat surface and adjust the pieces until all the legs are the same height.

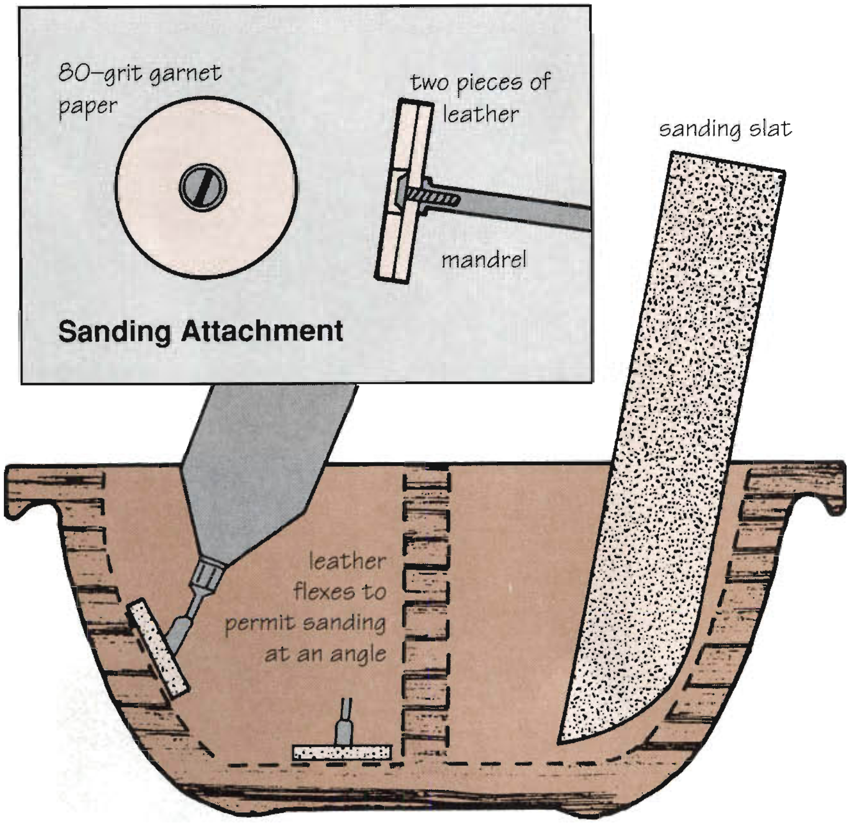


photos by the author

Turned and Carved Bowl



Removing Waste and Smoothing



Sanding Attachment

Sanding with the Rotary Tool and Sanding Slat

Carol Law

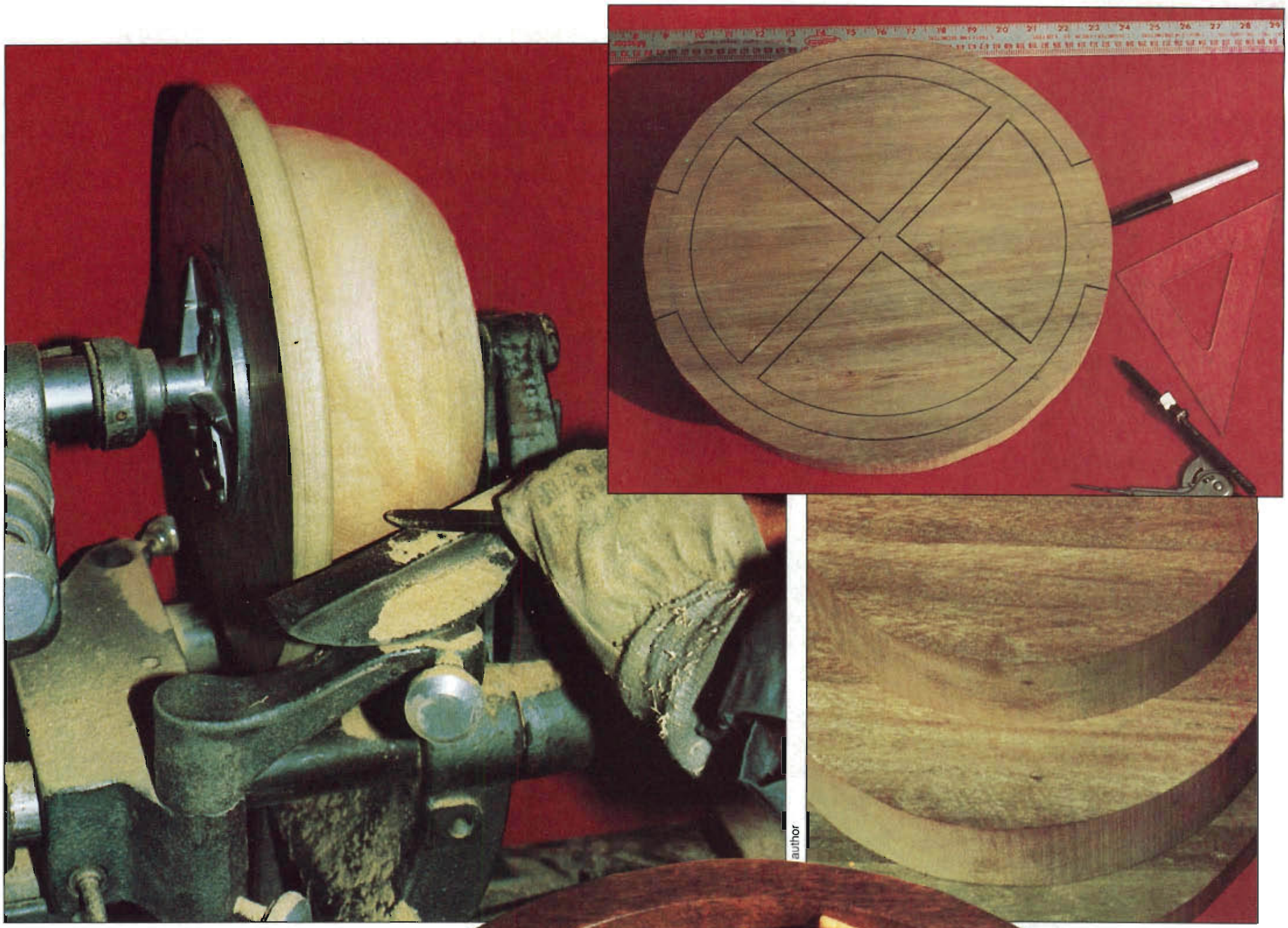
By Warren Asa

Time was when a turned bowl was a turned bowl, and a carved bowl was a carved bowl and never the twain did meet. But then turners took to decorating their bowls with grooved patterns and we had bowls both turned and carved. This bowl is both turned and carved, but not in the way you might think. The outside is turned while the inside is carved to form four compartments. I saw the original one summer in a museum and was intrigued by its good looks and practical value. It appeared to be a natural project for anyone into lathe work and carving. I asked the attendant what was known of its origin, and he said two things were known—it was made in Nepal in the 1890's, and it was used in the kitchen to hold cooking items like dried herbs, nuts and spices.

I was permitted to examine the bowl and make notes on its size and shape, but I was not allowed to whittle a piece off the bottom to see if I could identify the wood. It appeared rather open-grained, medium light in weight, quite strong, and had been stained a dark brown. The various woods sold as Philippine mahogany will fill the bill nicely. It's a fine serving bowl for nuts, dried fruit, chips, pretzels and candy. A smaller version could be a handy dresser accessory for keys, change, and the like.

I laid out the bowl full-size and considered possible modifications, such as eliminating sharp corners on each quadrant. But after close study, I must admit that the Nepalese craftsmen had hit on the best design—none of mine were as handsome.

You may have heard the story of the

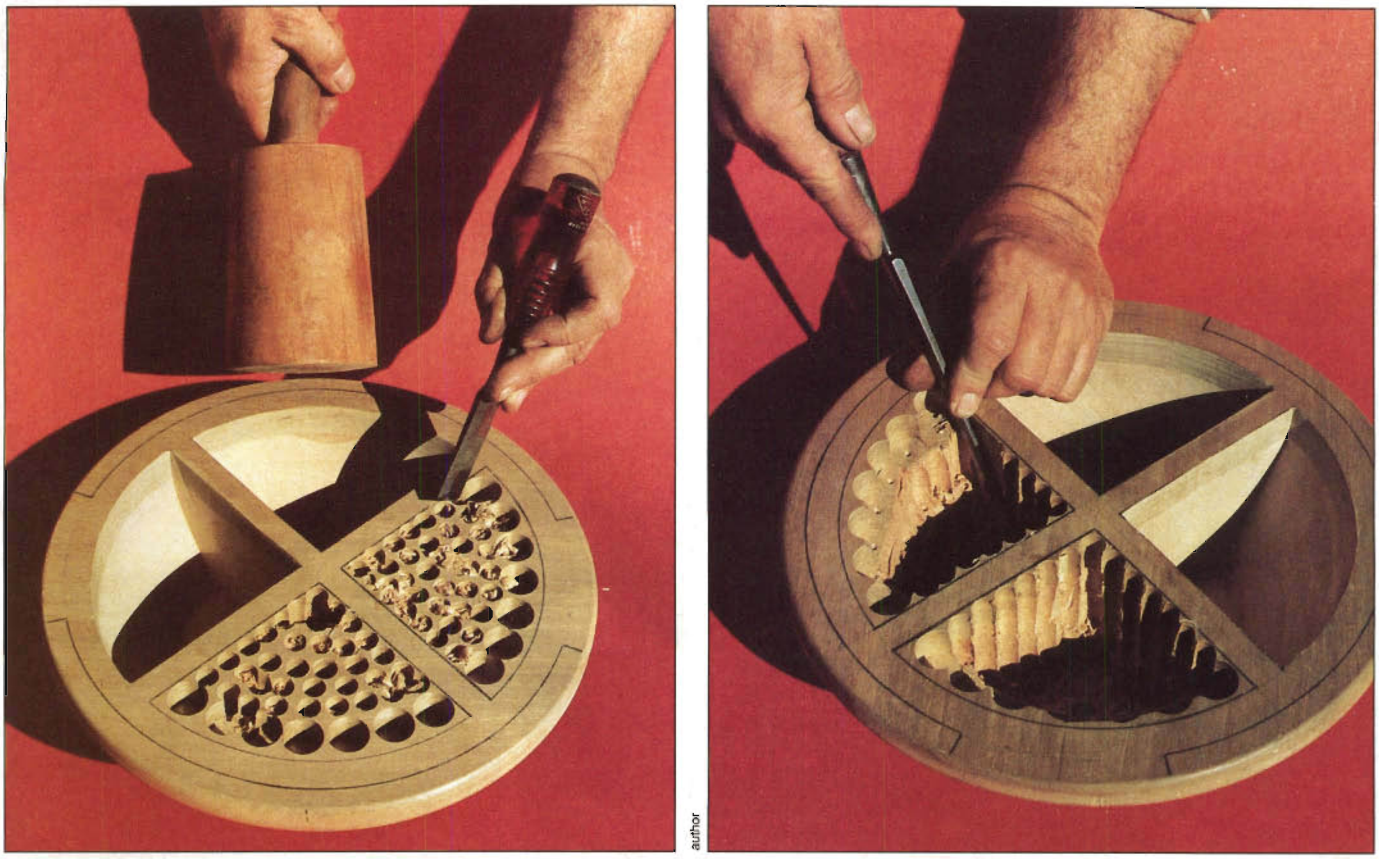


author

The bowl can turned from solid wood or from glued–up disks. The handles are cut later from the false rim visible in the lathe photo above.

country craftsman who sold clever, lifelike carvings of the local farm folk at a roadside stand. One city slicker, impressed with his work, asked if such carving wasn't very difficult. The carver replied that it was really quite easy—all he had to do was remove the unwanted wood. This project is no different. Remove the wood you don't want—saw out the disks used to glue up the bowl block, turn away the outside, carve out the inside, and remove the false rim.

The Figure and the pattern in the PullOut™ Plans show the dimensions and basic layout. I started by gluing up three panels, bandsawing a disk from each, and gluing these to form the bowl block. Yellow



author

Here, the partitions have been drilled out and the walls are being trimmed with a bevel–edged chisel.

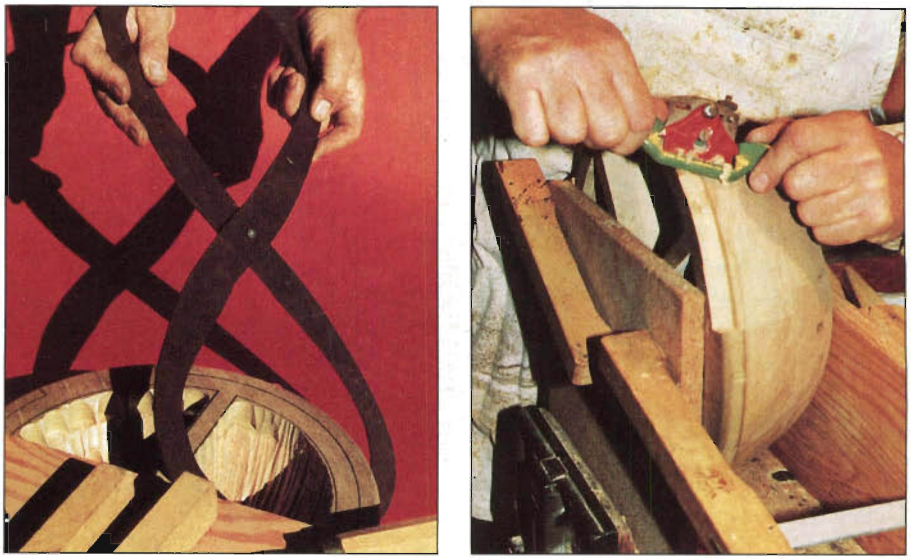
glue was used throughout. Of course, you can use a solid block if you have one large enough. Lay out the top of the bowl carefully—the inside and outside diameters, the four compartments, and the handles. I made the bowl wall and the partitions $^{5}/_{8}$" thick in the layout with the idea of working them down to $^{1}/_{2}$" in the finished project. The direction of the wood grain is important here. The Nepalese craftsman utilized the grain to great advantage, insuring strong handles and partitions, and so should you.

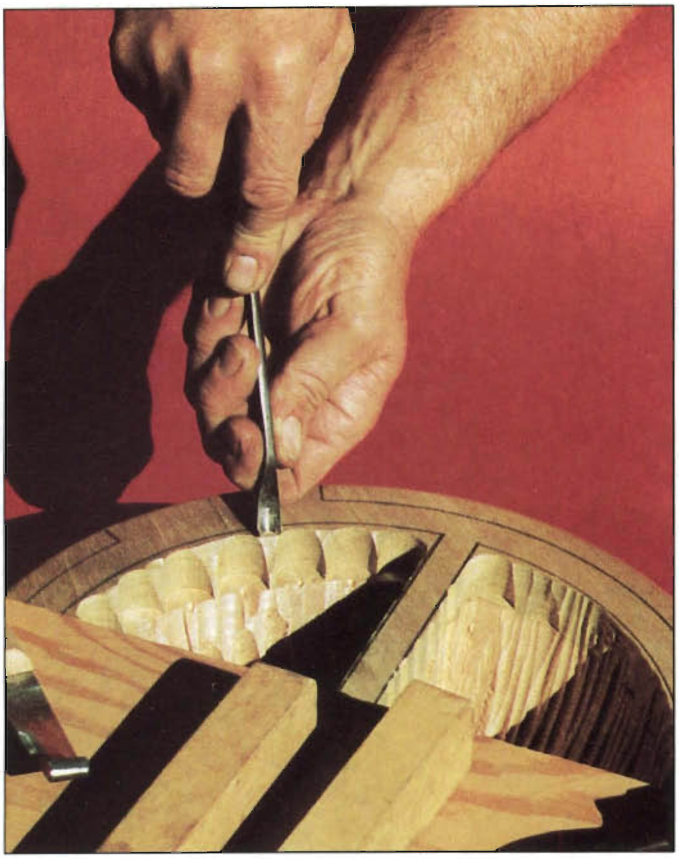
When attaching the bowl block to the lathe faceplate, be careful to locate all screws in the waste area between partitions. Turning the outside is an easy, straightforward lathe project, but there is a bit of a groove on the underside for the false rim. This provides a nice grip on the handles when the false rim is cut away. Finish sand the outside and remove the block from the faceplate.

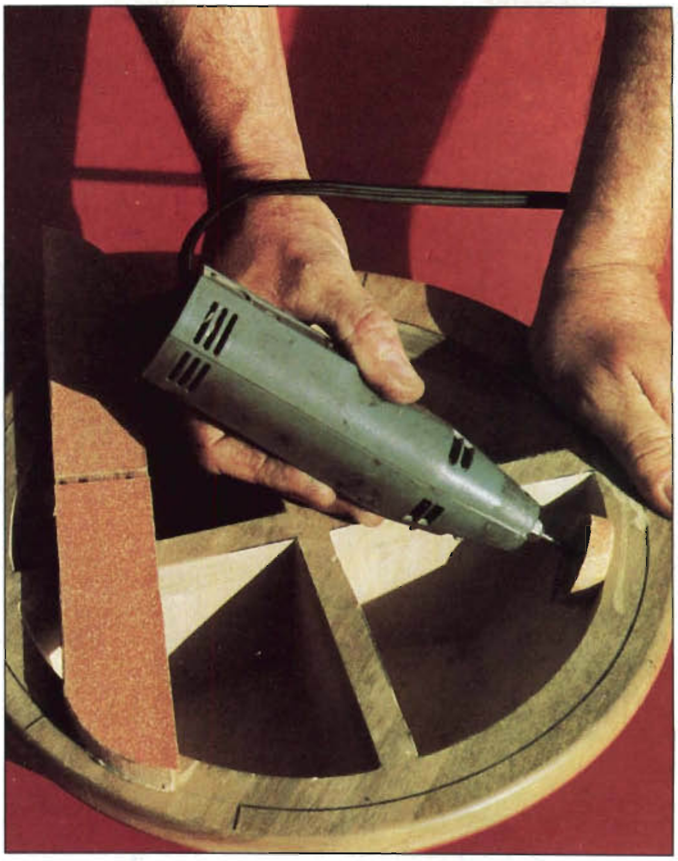
Removing the surplus wood within and smoothing up the interior could be done solely with hand tools, or with a woodhog, or perhaps started with a router. I had excellent results drilling out the wood with Forstner bits in my drill press. The photos above show my *plan of attack*. The drilling method has two advantages—the holes are 90° to the bottom, thus establishing straight sides for the partitions, and it's easy to drill to an exact depth, thus establishing the correct thickness for the bottom. Naturally, you must keep the drill away from the wood needed to form the bowl wall and partitions. After drilling, use a chisel and mallet to remove the fret–like scraps that remain. Little pressure is required to cut them free.

For me, the best part is carving the interior. Accuracy is essential. I gradually sneaked up on the layout lines with sharp chisels and was amazed at how accurate my work turned out. At one time or other I tried just about every cutting tool I own, including a crooked knife, a scorp, a spoonbottom carving plane, and even a linoleum block tool, as well as a few scrapers and rasps. A $^{1}/_{2}$" beveled edge chisel proved best for the sides of the partitions, while for the inside of the bowl

Below, shopmade calipers keep the wall thickness consistent. The photo to the right shows a spokeshave smoothing between the handles after the false rim has been sawn off.







I smoothed the inside with bent and spoon gouges, a curved, sandpaper–covered slat, and a shopmade sanding disk on a rotary tool.

walls I like bent and spoon gouges.

If you habitually keep your chisels very sharp let me suggest you touch them up before starting this phase. Don't even think of starting until they're razor sharp. You want your tools to be capable of removing thin shavings, including across end grain, with as little pressure as possible. You can accomplish most of the carving with hand pressure alone. When you must resort to using a mallet, wield it with a light hand—the last thing you want is a crack. On the handle quadrants the bowl wall inside is end grain, while the side quadrants present long grain. They must be worked differently, so proceed with caution.

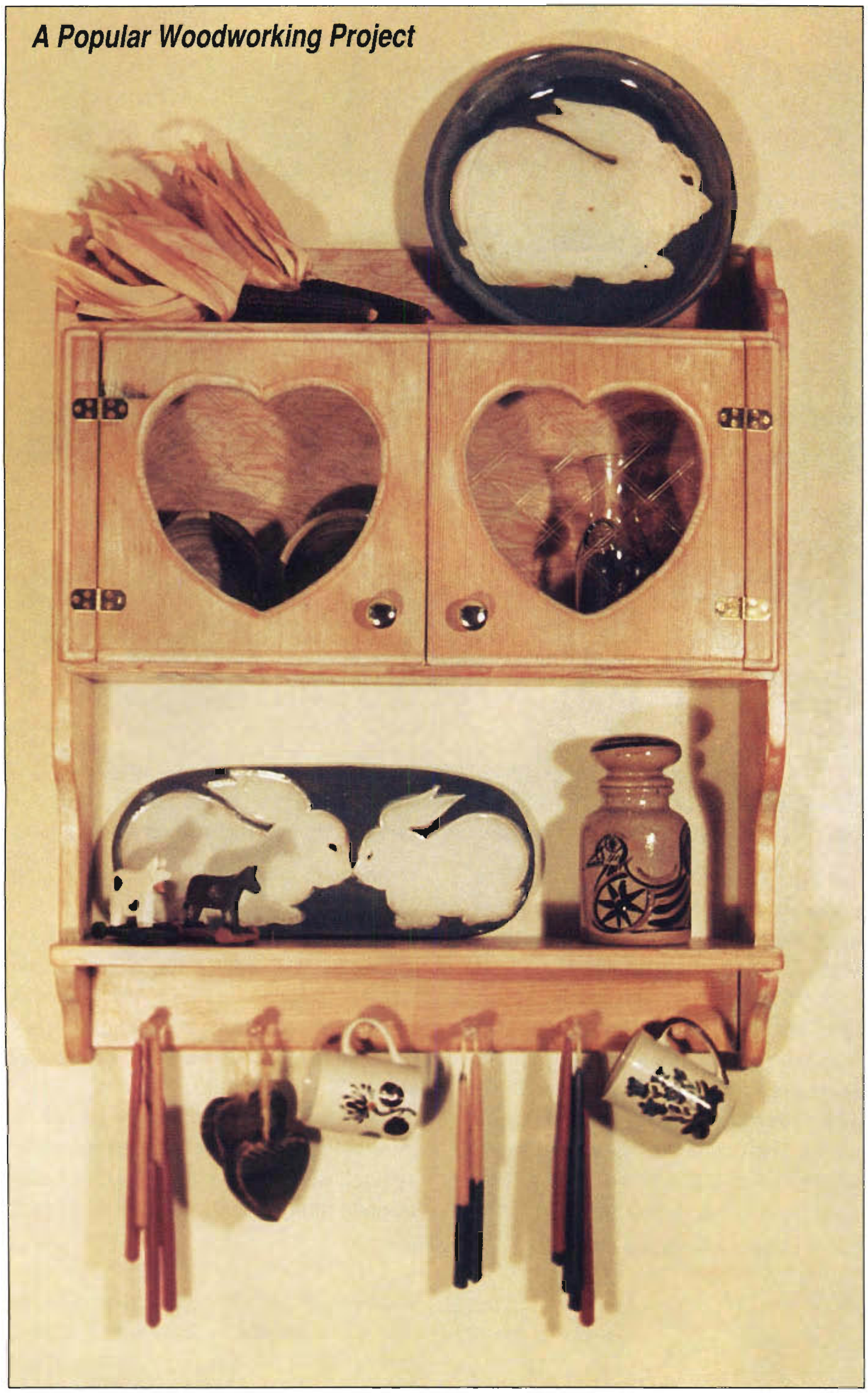
If you've carved accurately, you can start sanding with 80–grit garnet paper, but if your carving is a bit on the rough side, I suggest starting with 50– or even 36–grit. Two shopmade tools made sanding easier for me. I contact–cemented 80–grit garnet paper to the top and sides of a leather sanding wheel and mounted it in a mandrel designed for small grinding wheels (Figure 3). It can be used with a motor tool or with a flexible shaft, and the flexibility of the leather suits it well to the bowl's curved interior. The other tool is a $1\frac{1}{2}$" X $1\frac{1}{2}$" wood slat shaped as shown in the Figure. I used white glue to attach abrasive paper to all sides of the slat. It helps smooth the bowl's partitions, especially where they intersect the bowl walls. I did the final inside sanding by hand with small folded pieces of paper, working through 100, 150, 220, and finally 400–grit.

To darken the bowl, I stained it, inside and out, with homemade walnut hull dye.

The false rim adds strength to the bowl while you're carving out the quadrants, but now you're ready to remove it. A coping saw is quick and easy, and offers no threat to the work already finished. Smooth the saw cut with a spokeshave and sand it to match the outside of the bowl.

The original appears to have been stained a dark brown, but I have no idea what sort of stain the Nepalese craftsman used a century ago. Perhaps it was a vegetable dye. By simmering walnut hulls in water you can make a brown dye to darken the Philippine mahogany—I recommend two or more applications. If the water–based dye raises the grain, sand lightly with 400–grit paper. Finish with several coats of salad bowl finish. PW

A Popular Woodworking Project



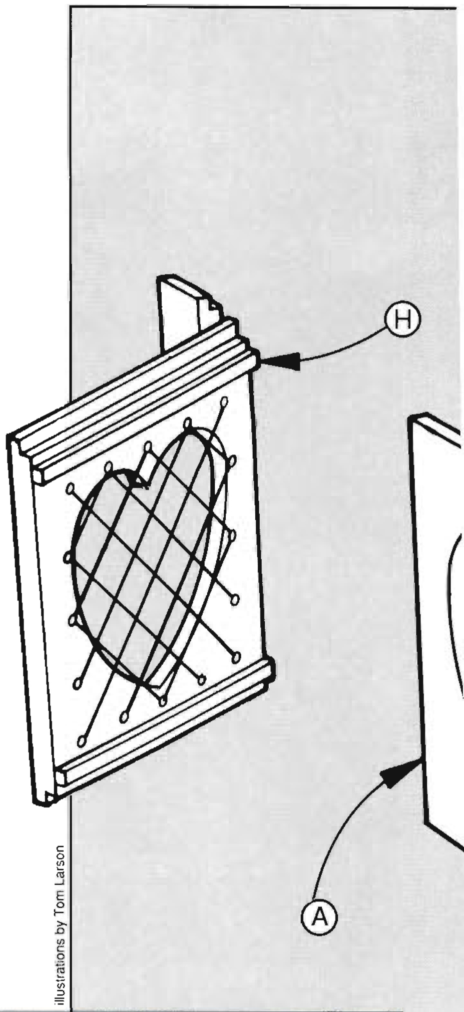
A Country Cupboard

by Howard V. French

This novel cabinet project features an attractive heart–shaped design with patterned "simulated glass" in both of its doors. It's relatively easy to make and is a great accessory for most any room in the house.

The one shown here is made of clear fir, with a whitewash and lacquer finish. Any wood will work, but if you use 1 X 6 pine or fir, a lot of the basic dimensioning will be done already.

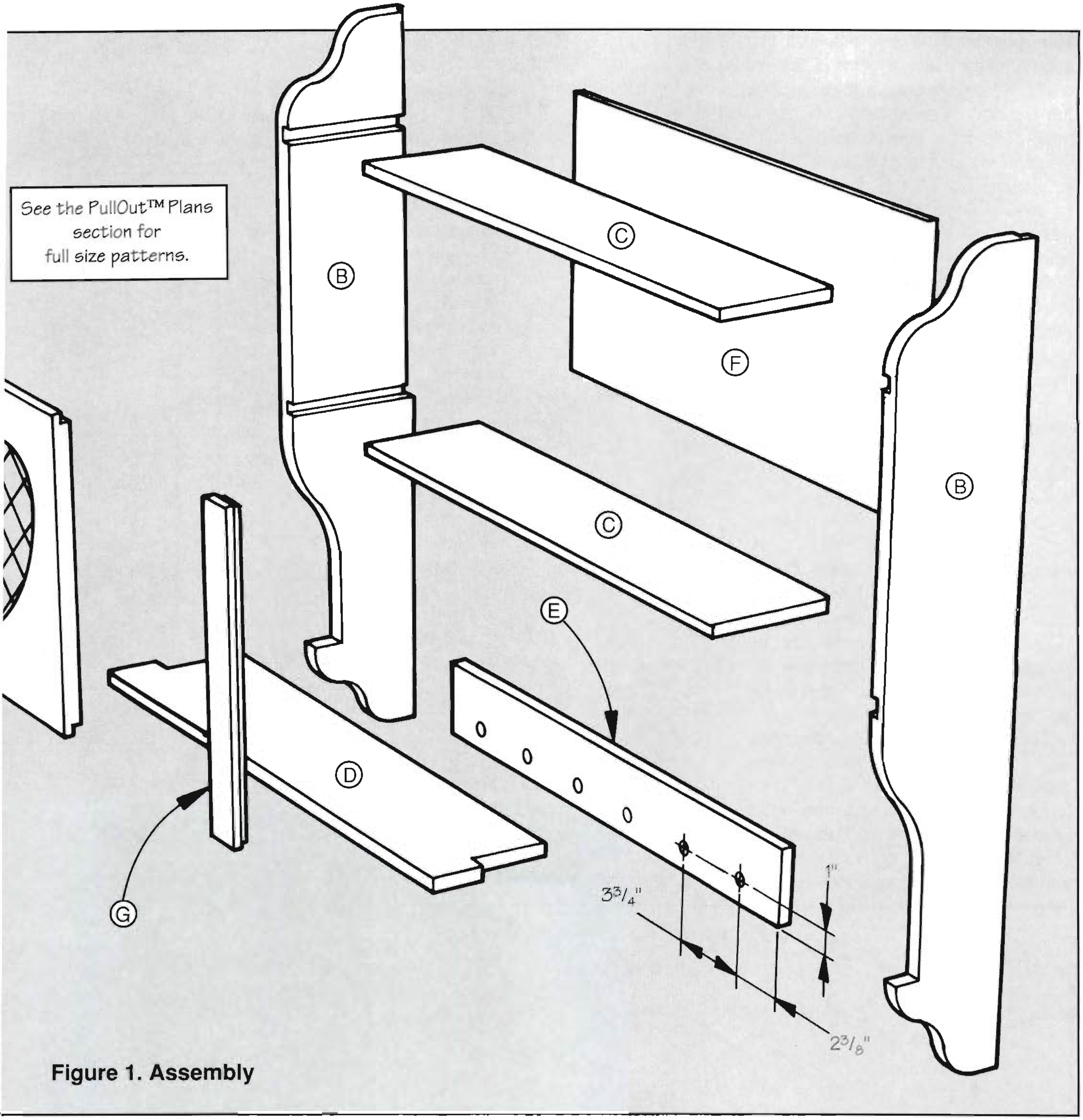
Start by cutting two 24" lengths of 1 X 6 and gluing them edge to edge. The resulting panel will be cut in half lengthwise to make up the two doors (A). Set the panel aside to dry while you start cutting the other pieces.



illustrations by Tom Larson

Country Cupboard					
Cutting List					
		Finished Size			
Qty	Part	T	W	L	Piece
2	A	3/4"	10 7/8"	11 1/4"	doors
2	B	3/4"	5 1/2"	30"	sides
2	C	3/4"	5 1/4"	24"	upper shelves
1	D	3/4"	5 1/2"	25"	bottom shelf
1	E	3/4"	3 1/2"	23 1/2"	peg board
1	F	1/4"	16"	24 1/2"	back
2	G	3/4"	1 1/4"	11 3/8"	door supports
4	H	1/4"	3/4"	10 1/4"	battens
Supplies					
4	decorative hinges				
2	pulls				
6	small Shaker pegs				
	#10 X 5/8" tacks				
	25 lb. test fishing line				
	finishing nails				

***Howard V. French** lives in Abilene, Texas, where he spends his time dreaming up woodworking projects.*



See the PullOut™ Plans section for full size patterns.

Figure 1. Assembly

Cut the sides (B), shelves (C and D), and peg board (E) to length as indicated in the Cutting List. If you're working with 1 X 6's, the sides and the bottom shelf will already be at their finished width of $5^{1}/_{2}$". Rip the upper shelves (C) to $5^{1}/_{4}$" so they'll clear the back (F) (see Figure 1). Rip the peg board to its finished width and use the scrap to make the door supports (G). I cut a slight chamfer along the bottom front edge of the peg board.

Cut a $^{3}/_{4}$" X $3^{1}/_{2}$" notch in the ends of the bottom shelf as shown in Figure 1. Now lay out the cabinet sides using the full–size pattern in the PullOut™ Plans section of the magazine, and cut it out using a band saw or scroll saw.

Before you set up to cut the dadoes, unclamp the panel you glued earlier, scrape and sand it, and cut it to size for the two doors (A). Trace the heart pattern (from the PullOut™ Plans) onto the fronts of the doors; then drill starter holes and cut out the hearts with a scroll saw. (If you position the starter hole carefully, you can use the cutout pieces to make a pair of small knick–knack shelves or sconces. See the sidebar on page 84.) Rout the inside edges of the cutout, the top and bottom edges of the doors and three edges of the door supports (G) with whatever edge treatment you like. By doing this now, you'll still have an edge to support the guide bearing.

Now set up the table saw or your router table to cut $^{3}/_{8}$" deep by $^{3}/_{4}$" wide dadoes. Cut the two dadoes in the sides to receive the upper shelves; be careful to orient the pieces properly, so you end up with a right and a left instead of two that are the same.

Then position a wooden fence so that only $^{3}/_{8}$" of the cutter is exposed, and cut the $^{3}/_{8}$" X $^{3}/_{8}$" rabbets along the back of the top and bottom edges of the doors and three sides of the door supports. Finally, move the wooden fence over another $^{1}/_{8}$" so you can cut $^{1}/_{4}$" X $^{3}/_{8}$" rabbets on the inside back edges of the sides (B). These rabbets should be stopped at the point where they cross the center shelf dado.

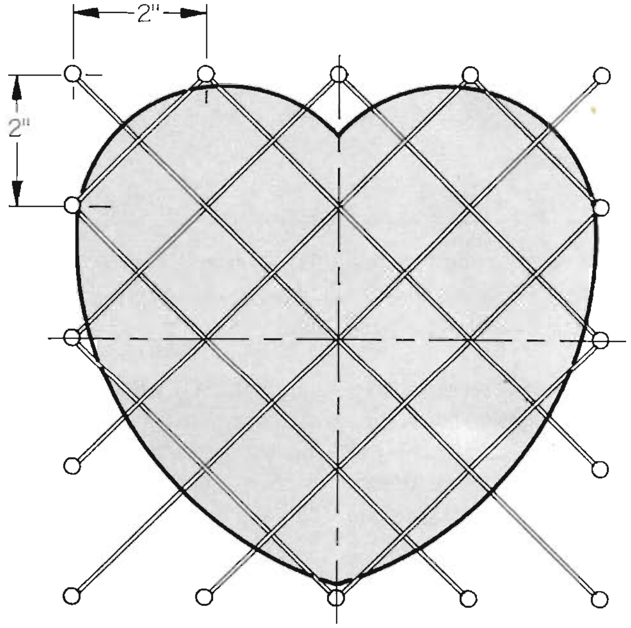
Lay out the peg hole centers on the peg board as indicated in Figure 1, and drill them halfway through the thickness of the board. I used small Shaker pegs (#158 from Cherry Tree Toys, P.O. Box 369, Dept. PW, Belmont, OH 43718, phone 614-484-4363) which require a $^{3}/_{8}$" hole. If you like, you can make your own pegs from $^{1}/_{2}$" dowel stock; if you do, size the holes accordingly.

Once you cut the back (F) to size from $^{1}/_{4}$" plywood or MDF, you're ready to assemble. Glue and nail the upper shelves into their dadoes and the bottom shelf in place at the notch. Run a bead of glue along the top edge and the ends of the peg board and nail it in place. Temporarily tack on the back to square the unit while the glue sets.

I applied my finish without the pegs, door supports, doors or back installed. After a coat of Minwax® Wood Conditioner, I rubbed on some thinned white paint and rubbed off as much excess as I could. When this was dry, I sanded lightly with 220-grit and then applied several coats of Deft® Clear Wood Finish.

At this point you are ready to "glaze" the doors. Lay the finished doors face down on a clean work surface. Lay out the locations for the tacks as shown in Figure 2, and drive in #10 X $^{5}/_{8}$" tacks to within $^{1}/_{16}$" of flush. Using 25 lb. test monofilament line,

Figure 2. The Layout of the Tacks

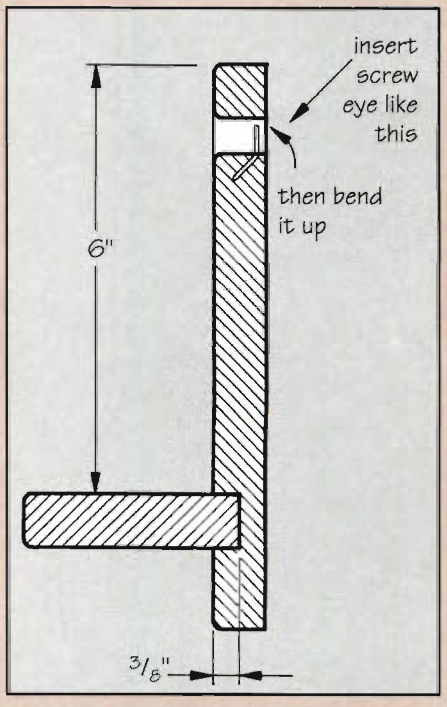


Illustrations by Tom Larson

Heart Sconce

Save the heart–shaped cutouts from your country cupboard doors to make these charming little sconces. Make a shelf out of $^{1}/_{2}$" material that is approximately $3^{1}/_{2}$" X 7". You'll find a full–size pattern for the shelf in the PullOut™ Plans section. Cut it out and sand the edges; then rout a $^{1}/_{2}$" wide X $^{3}/_{8}$" deep dado in the heart cutout to accept it.

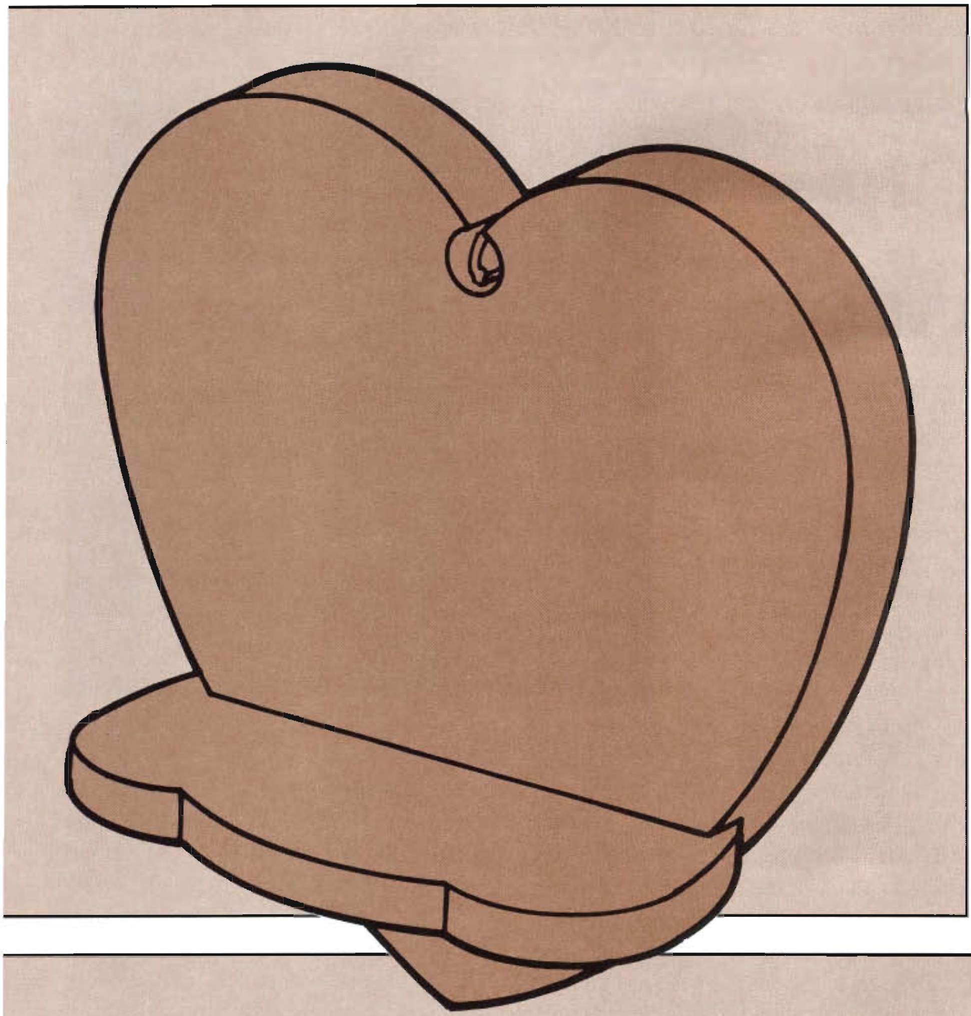
Insert a screw eye in the starter hole by screwing it in at an angle and then bending it straight, as shown. **PW**



Hidder

Here's an idea for hanging your country cupboard without visible hardware. Make these little hangers from sheet metal or readily available metal straps. Cut them to size and round the ends as shown. Then drill holes to accept standard screw shanks, but when you bore the countersinks, bore one on one side and one on the back.

Position them near the top of your project and drive a screw into the bottom holes. Attach them to the wall by pivoting them to drive in the screws or mollies; then swing the unit over to cover them up (you'll have to attach one, then pivot it the other way to attach the other). **PW**

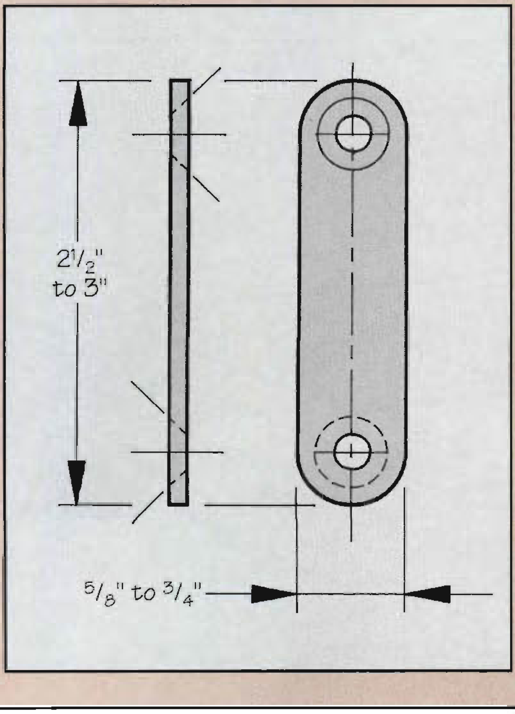


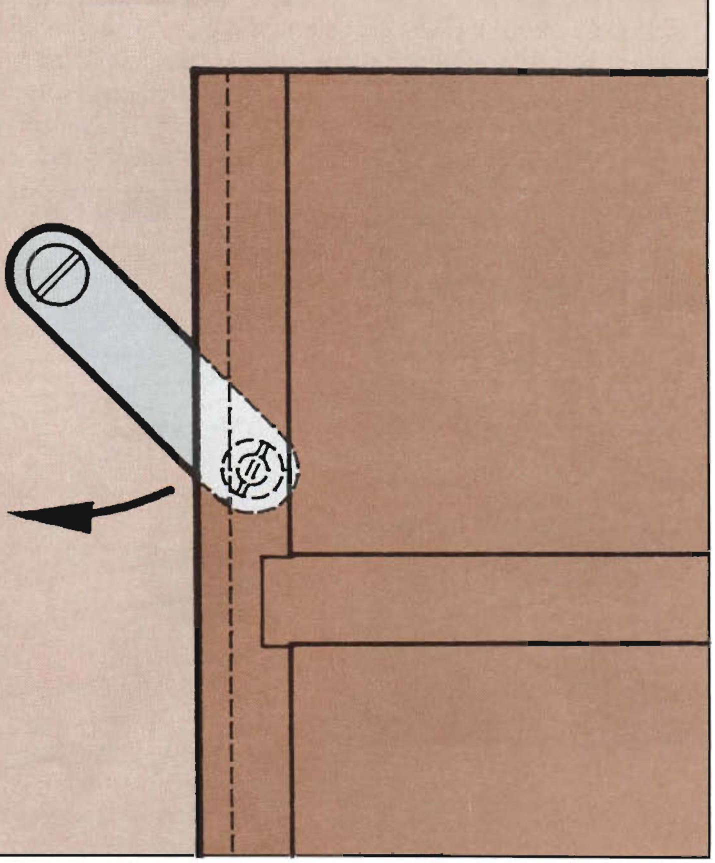
form loops around the tack heads as shown. Stretch them tight and tie the ends securely—a single knot will do. Once you have finished tying the loops in one direction, tie the remaining courses weaving over and under the previous courses. Once this is done, take a small drift punch and "set" the tack heads against the wood without cutting through the lines. Now spray the end of a cotton swab with clear acrylic and use it as a brush to dab on a drop at each tack head. After checking to see that all the ends are clipped off cleanly, spray clear acrylic over both the front and back surfaces of the fishing line.

To reinforce the doors, I glued and tacked a pair of battens (H) to the back of each, across the top and bottom. This reinforces the short grain areas created by cutting out the hearts.

Now install the doors with decorative hinges and apply whatever pulls you choose. Attach a magnetic catch to the underside of the top shelf in the center and screw an iron washer to the upper inside corner of each door to contact the magnet. Glue the pegs into their holes, then permanently install the back and you're ready to hang your country cupboard. PW

Hangers





A Small Chest of Drawers

author

by H. Wesley Phillips

When we moved my wife's piano from her childhood home to ours, we needed extra storage for sheet music. The long, shallow drawers found in map cabinets seemed just the ticket, so I modelled this project after a colonial map chest. The moulding and hardware make it an elegant piece, and it looks great as a lamp table between two armchairs. It's relatively easy to build, and although I made mine from pine and painted it, this chest really lends itself to hardwood construction.

Side and Back Panels

Select stock for the side panels (A) first. I used yellow pine with few knots, ripped into 5" to 6" widths. If you're not painting the chest, select the exterior surfaces and adjoining edges to achieve a pleasing overall grain pattern. Plan the panels so they'll be slightly oversize, and glue and clamp the pieces together. While they're drying, cut the back (B) from $^1/_4$" hardwood plywood. Then sand the side panels smooth and trim them to the dimensions in the Cutting List.

Mark and cut the grooves for the rails carefully. They must be spaced identically on each panel for the chest to end up level and square (Figure 1). Place the panels side by side, and with a long straight edge or T-square, lay out the grooves on both pieces at once. I used a router to cut them. The bottom and top dadoes are $^3/_4$" wide X $^1/_4$" deep, while the middle three are $^1/_2$" X $^1/_4$". Along the back edge of the side panels cut a $^3/_8$" X $^1/_4$" rabbet for the back using the table saw and dado blades.

Cut slots on the inside bottom of the panel as shown in Figure 1. You'll attach the skirts to the panels using round head screws with washers in these slots. The slots permit the wood to move during changes in humidity.

Rails

Each drawer slides on a framework of rails (C–F) held together by corner lap joints and made from poplar for added strength. A dust panel (G or H) is fitted inside a $^1/_8$" groove on the inside edge of each frame (Figure 2). Begin by ripping the rails to width and length. While you're at it,

H. Wesley Phillips is an electronics engineer who spends his spare time woodworking in Greer, South Carolina.

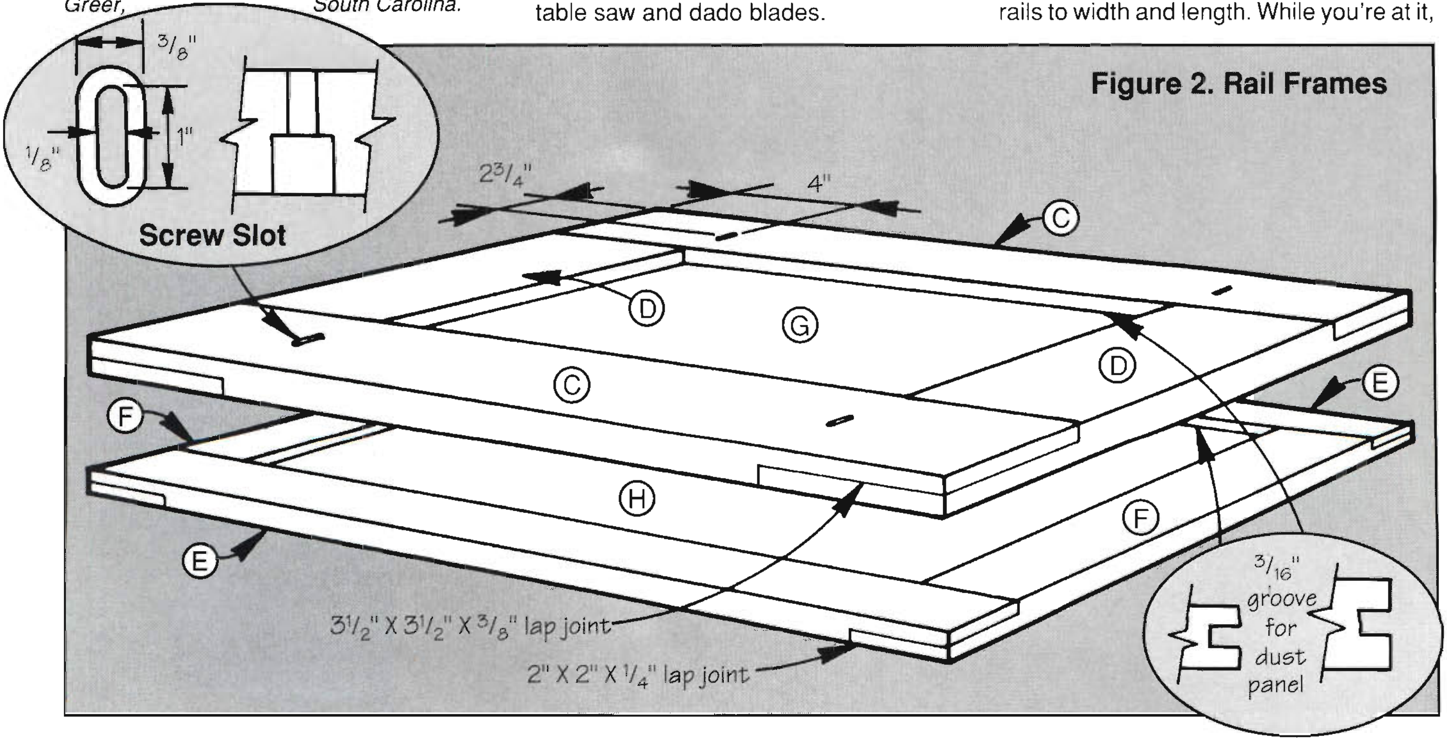
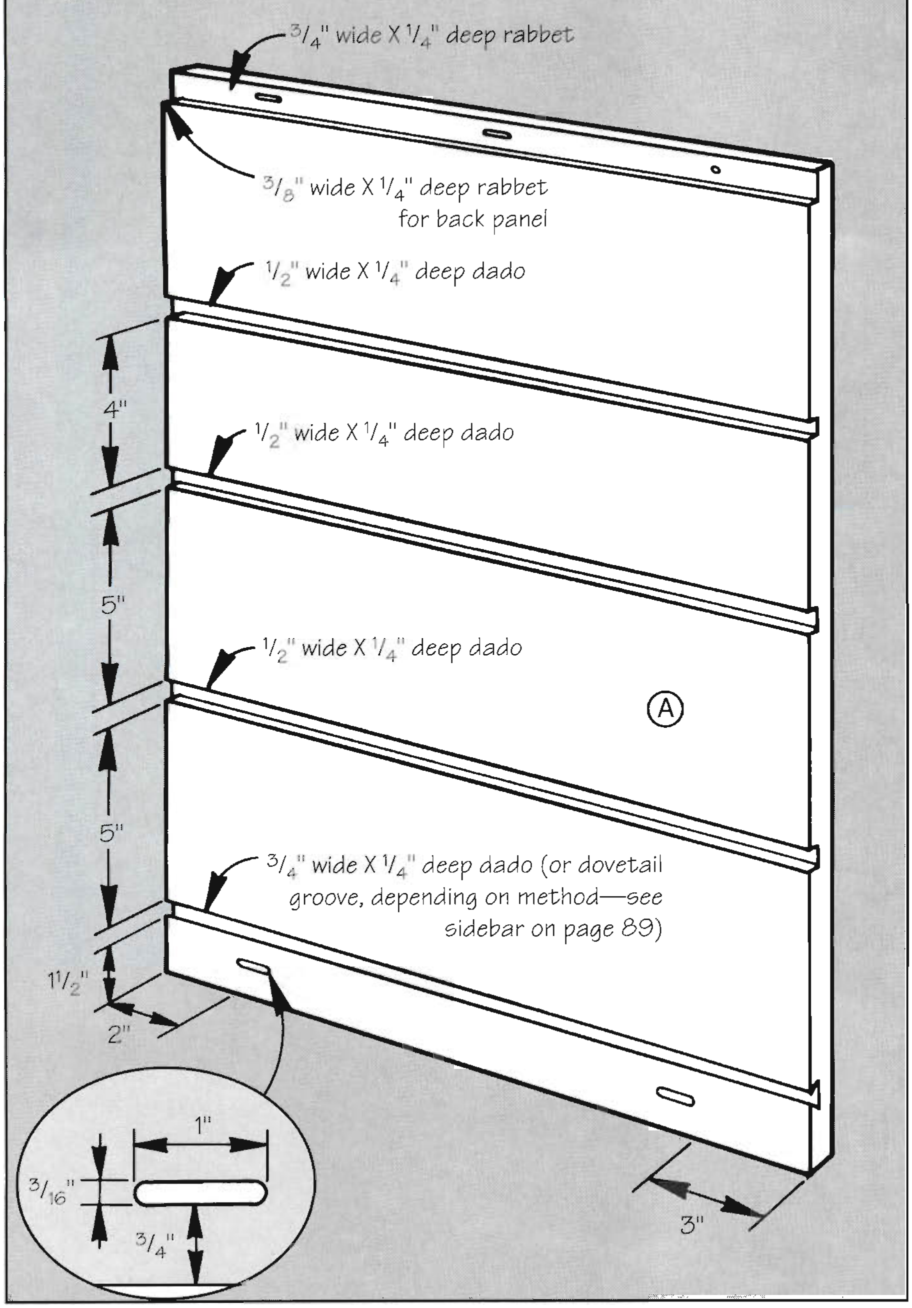


Figure 2. Rail Frames

Figure 1. Side Panel


3/4" wide X 1/4" deep rabbet
3/8" wide X 1/4" deep rabbet for back panel
1/2" wide X 1/4" deep dado
1/2" wide X 1/4" deep dado
1/2" wide X 1/4" deep dado
3/4" wide X 1/4" deep dado (or dovetail groove, depending on method—see sidebar on page 89)
A
4"
5"
5"
1 1/2"
2"
1"
3/16"
3/4"
3"

Bob Chapla

dimension the braces (I) you'll need for assembly of the case later.

Cut the lap joints on the table saw using a dado blade. I clamped a stop block to the fence and set it at 3 1/2" from the outside of the dado blade for cutting parts D and C (2" for parts E and F). This establishes the shoulder of the lap joints. Move the piece over with successive passes until the rest of the waste is gone. Place the stop block *ahead of the blade*, not next to it, to prevent the work from touching the fence and possibly binding as it passes through the blade. Raise the blade 3/8" above the table and adjust the fence so the first cut marks the full length of the lap joint. You can minimize tear–out by backing up the work with a piece of scrap.

When the lap joints are done, cut a 3/16" groove for the dust panels on center on the inside edge of each rail. The kerf from a carbide tipped saw blade is about 1/8" so cut this groove in two passes. Test fit all the joints before gluing and, if necessary, trim with a block plane or chisel.

Cut slots in the front and back top rails (C) as shown in Figure 2. When the top (J) is screwed down, these slots allow the wood to expand and contract. I glued up the rails using C–clamps and pads at all the corners, adjusting for squareness before the glue set. When the glue is dry, joint 1/8" off the back edge of each frame to accommodate any contraction of the side panels.

Small Chest of Drawers

Cutting List

Qty	Part	Finished Size T	W	L	Piece
2	A	3/4"	17 1/2"	24 1/2"	side panels
1	B	1/4"	22"	22 3/4"	back
4	C	3/4"	3 1/2"	22"	front/back rails
4	D	3/4"	3 1/2"	17 1/8"	side rails
6	E	1/2"	2"	22"	front/back rails
6	F	1/2"	2"	17 1/8"	side rails
2	G	1/8"	11 9/16"	15 7/16"	dust panels
3	H	1/8"	13 9/16"	18 7/16"	dust panels
2	I	3/4"	1 1/2"	21 1/2"	braces
1	J	3/4"	19 3/8"	21 1/4"	top
3	K	3/4"	1/2"	21 1/2"	facing
1	L	3/4"	2"	21 1/2"	facing
1	M	3/4"	2 1/4"	21 1/2"	facing
2	N	3/4"	3/4"	24 1/4"	facing
1	O	3/4"	4"	24 1/2"	front skirt
2	P	3/4"	4"	19"	side skirts
2	Q	3/4"	2"	19 3/8"	top edges
1	R	3/4"	1 1/8"	24 1/2"	front moulding
2	S	3/4"	1 1/8"	19 3/8"	side mouldings
2	T	3/4"	4 15/16"	21 3/8"	drawer fronts
4	U	1/2"	4 15/16"	17 1/2"	drawer sides
2	V	1/4"	4 1/2"	20 7/8"	drawer backs
2	W	1/4"	16"	20 7/8"	drawer bottoms
2	X	1/4"	3 15/16"	21 3/8"	drawer fronts
4	Y	1/4"	3 15/16"	17 1/2"	drawer sides
2	Z	1/4"	4"	20 7/8"	drawer backs
2	AA	1/4"	16"	20 7/8"	drawer bottoms
3	BB	3/4"	1"	3"	drawer stops

Case Assembly

Make certain the rail frames fit the dadoes in the side panels. Before assembling, you may want to finish the interior surfaces with a dark stain and a couple coats of thin–cut shellac. Once dry, apply glue in the grooves, press in the rails, and clamp the assembly together. (If you're concerned about the possibility of wood

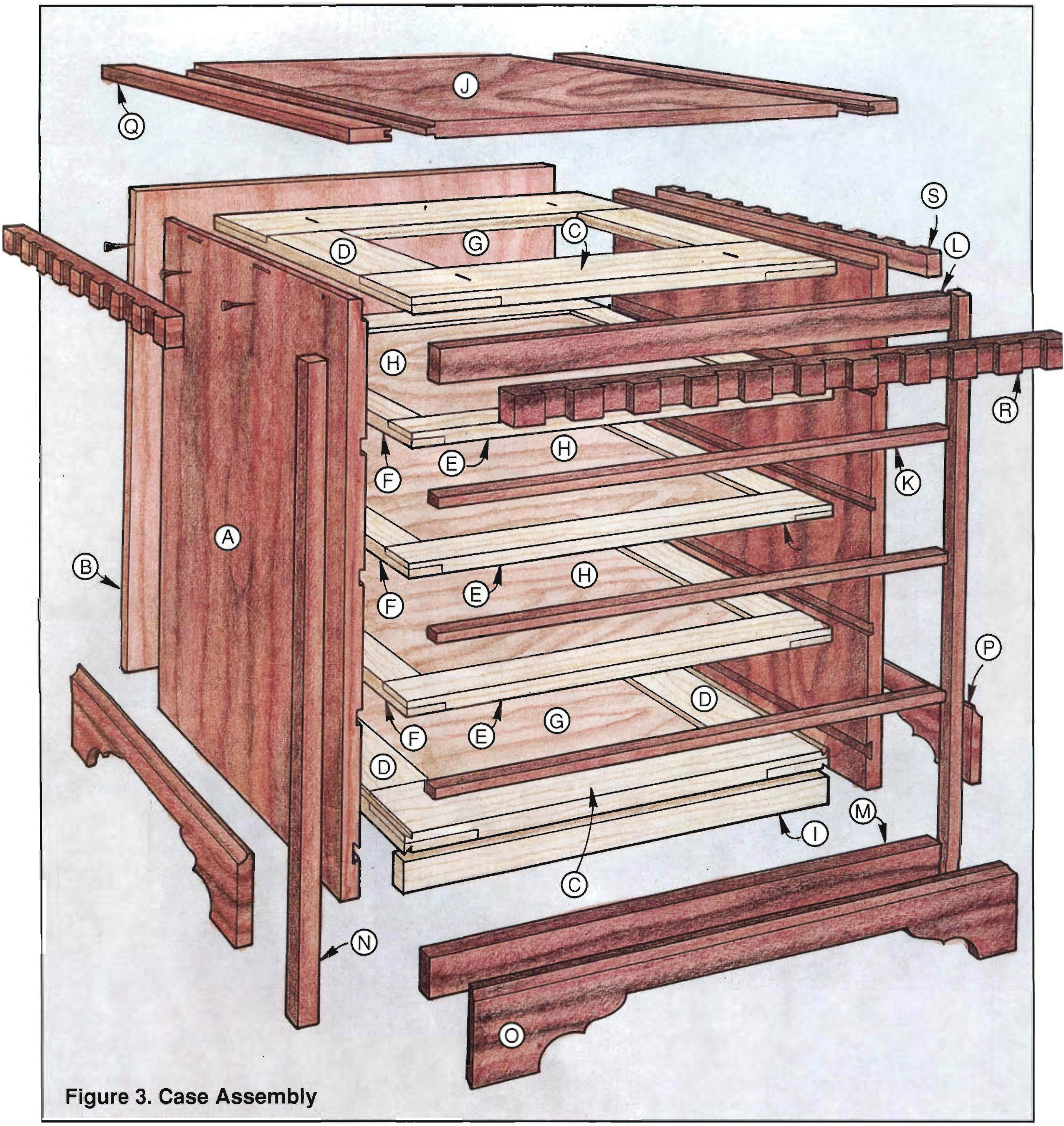


Figure 3. Case Assembly

movement here, see the adjoining sidebar for another method of joining the frames and sides.) Make sure the top rail frame—with the slots oriented correctly—is on top. Check for squareness top to bottom and front to back. If you're going to paint the project, drive a couple of finishing nails through the side panels into the rail frames. Now glue the bottom braces (I) flush to the front edge and snug up against the bottom rail frame.

By putting on the facing strips (K–N), you're covering the dadoes and better defining the lines of the case. Furthermore, if you're not going to paint the piece and you're using a select hardwood, the facing strips make it possible to use a less expensive wood for the frame assemblies. Cut and test fit each piece to the assembled case individually. Attach them with glue and 1" brads, and finish sand everything.

Skirt

Cut the stock for the skirt a bit long and rout the decorative top edge with a roman ogee bit before cutting it into pieces. The front (O) and sides (P) are mitered together; measure and cut the front first, then cut the miters on the front end of the

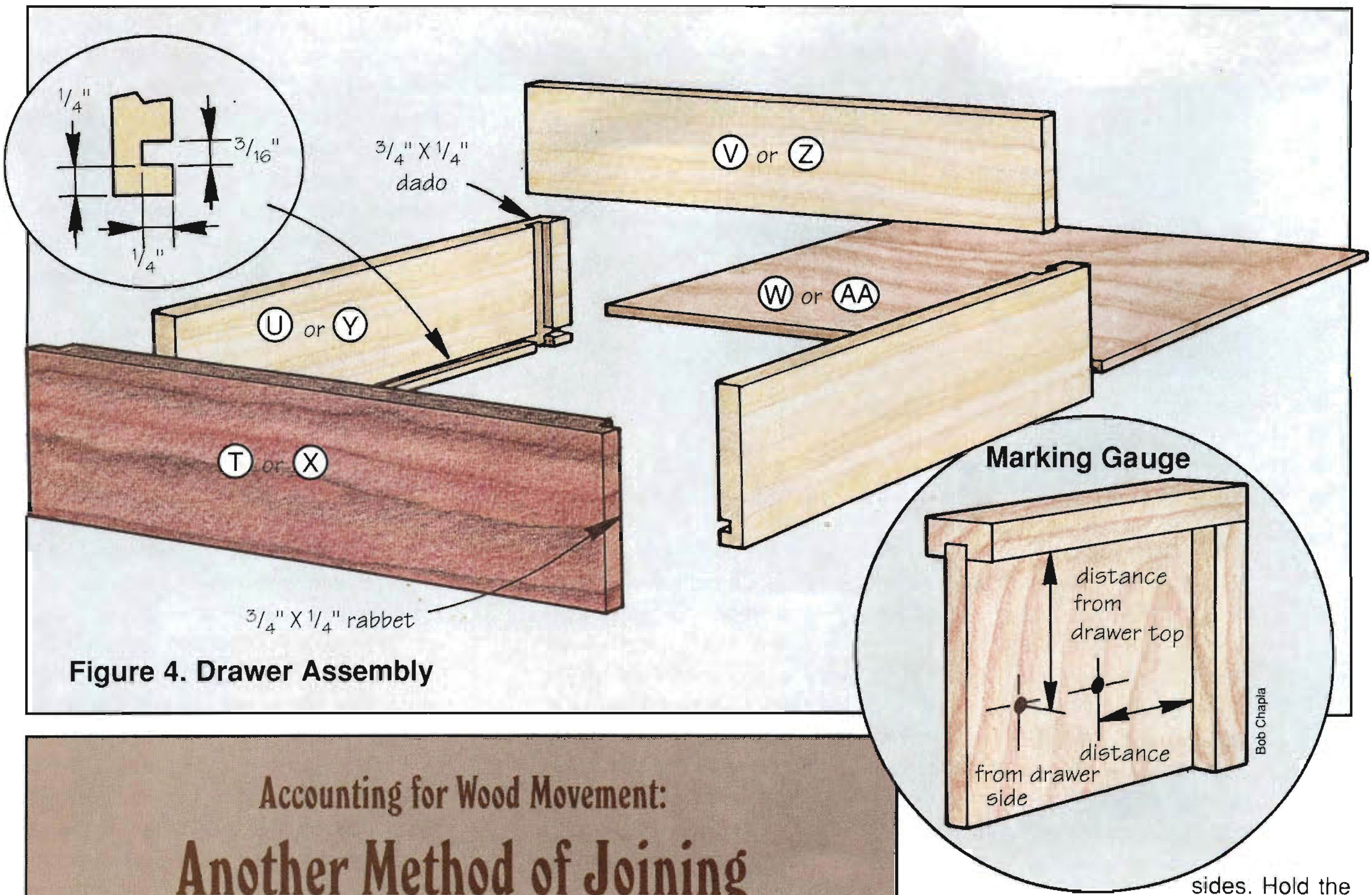


Figure 4. Drawer Assembly

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sides. Hold the skirt sides in place and mark their length; then trim them square. Using the pattern provided in the PullOut™ Plans section of the magazine, lay out the curves on the skirts and cut them out. After you've sanded them, mark the carcase $1\frac{1}{4}$" up from the bottom and attach the front skirt from behind with #6 X $1\frac{1}{4}$" wood screws. Attach the side skirts with #6 X $1\frac{1}{4}$" pan head screws and washers. Center the screws in the slots you cut earlier in the side panels.

Top

You could make the top from one piece of glued up stock, but I made it with 2" "breadboard edges" (Q) because they add character and elegance, as well as eliminate the problem of sanding a lot of end grain. Furthermore, they help keep the top flat. As with the side panels, glue up the top panel from 5" to 6" wide stock. When dry, remove excess glue, sand smooth, and cut to finished size. To attach the edges to the panel, you'll need to cut a $\frac{1}{4}$" X $\frac{3}{8}$" tongue centered along the ends of the panel with the table saw or router. Cut an inch or so off the tongue at each corner.

Rip the edge stock to 2" and cut the pieces slightly long. Then use a plunge router to cut a $\frac{1}{4}$" wide X $\frac{3}{8}$" deep groove

Accounting for Wood Movement:

Another Method of Joining

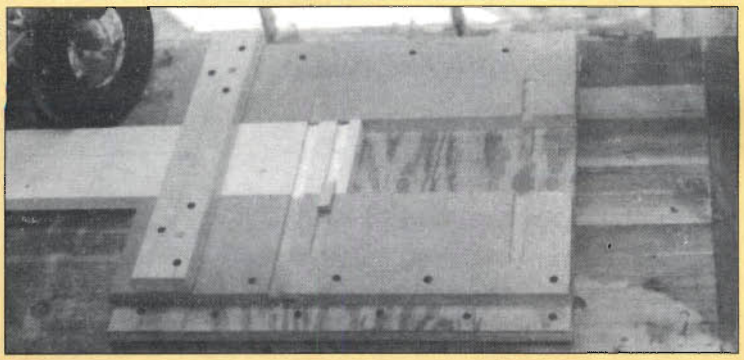
The method of joining the side panels to the rail frames given in the text of the article is simple and straightforward, but it doesn't allow for wood movement. This shouldn't be a problem if you use properly dried wood, seal it with paint or varnish, and keep the chest where the humidity is stable. But if you're using hardwood and a more open finish, or thinking about scaling up the size of the project, you'll want to modify the method to allow for some expansion and contraction of the panels.

Rather than cutting the dadoes as described on page 82, cut dovetail grooves in the side panels and correspondingly shaped tongues on the rail frames. They'll provide plenty of strength to hold the case together, making glue unnecessary and permitting expansion and contraction. This is the method illustrated in Figures 1 and 3.

The most efficient and accurate way to make these cuts is with a fixture for holding the stock and router similar to the one illustrated in the Jig Journal on page 90. The two guide rails should be just long enough to let the side panels slide under them and between the fixture's side pieces. Make the distance between the guides equal to the diameter of your router base. As with the dentil routing fixture, notch the side pieces with the same bit you use for cutting the dovetail grooves so you can precisely line up the cutting line on the panel with the bit. (You won't need the extra indexing slot.)

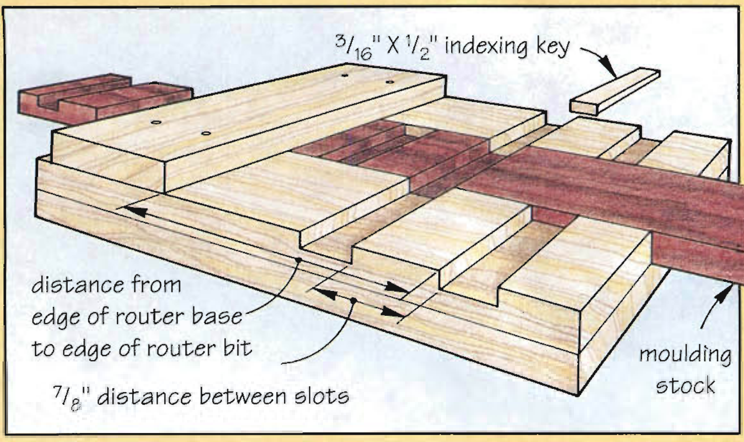
To cut the dovetailed tongues on the rail frames you'll need a router table with a high fence. Since the rail frames must be held against the fence vertically, you may want to clamp on an auxiliary fence. Cut one side of the tongues on all the frames and on some same–sized scrap. To find the fence setting that will result in a tongue that fits for the dovetail groove, practice on the scrap. You should be able to slide the tongue in its groove without forcing. PW

Jig Journal


author

Routing Dentil Moulding

Make the dentil moulding around the top of the chest with a router. To space the cuts accurately and efficiently, set up the fixture shown here. I made mine with a $^{1}/_{2}$" slot and $^{7}/_{8}$" spacing between each slot. First rip your stock to 3" wide. Then set the router bit to a $^{1}/_{4}$" depth, slide the stock in the fixture, and cut the first slot. You may need to clamp the stock on the righthand side. Then slide the stock just enough to fit the indexing key in the slot you just cut and the indexing slot on the fixture. Cut the next slot and repeat the procedure along the entire length. Then rip the moulding to the finished width of $1\,^{1}/_{8}$". Now, using a $^{1}/_{4}$" cove bit, rout a small radius along one edge of the mouldings. When cutting them to final length, be sure to center them so that the miters will fall in the same place on each side with respect to the teeth. PW


3/16" X 1/2" indexing key
distance from edge of router base to edge of router bit
moulding stock
7/8" distance between slots
Bob Chapla

centered along one edge of each piece to receive the panel tongue. This groove should be stopped at $^{3}/_{4}$" from both ends. Don't use any glue to attach the breadboard edges. Instead, fit them over the tongue; then drill partway through from the bottom at the center of the breadboard edge to insert a dowel pin. You can glue this pin into its hole. Use a $^{1}/_{2}$" cove bit to shape the decorative edge around the underside of the assembly (Figure 3).

Attach the top assembly to the carcase with $1\,^{1}/_{4}$" pan head sheet metal screws and washers in the same way you attached the skirt. For a quick and easy way to make the dentil moulding (R and S), see the sidebar above. Attach the moulding with small finishing nails, set the nails, fill the holes, and sand everything smooth.

Drawers

Figure 4 illustrates the type of drawer construction I used. Begin by cutting the fronts (T and X) and sides (U and Y) to length—I used poplar for the sides. I also cut off the upper back corner of each side piece to make loading and unloading the drawers easier. Cut $^{3}/_{16}$" wide X $^{1}/_{4}$" deep grooves in the fronts and sides to accept the drawer bottoms (W and AA). Adjust the fence and make two passes just as you did for the dust panel grooves in the rails. Rabbet the ends of the front pieces, $^{1}/_{2}$" wide X $^{3}/_{8}$" deep, to receive the sides, and cut $^{3}/_{4}$" wide X $^{1}/_{4}$" deep dadoes in the sides for the back pieces (V and Z).

Glue and nail the sides to the front, and slide the bottom in. Then glue and nail in the drawer back, and secure the bottom to it with brads.

Drill the $^{1}/_{8}$" mounting holes for the drawer handles. You'll want traditional style hardware similar to mine to match the style of the chest, and you can get it in a well–stocked hardware store, or by mail from GarrettWade (161 Avenue of the Americas, New York, NY 10013-1299) and other mail order firms. For precise and easy placement of the drawer handles, make the marking jig shown in Figure 4.

Finally, load the drawers in the chest so they're flush with the facing. Fit the drawer stops (BB) to the undersides of the rail frames, snug against the drawer backs, and glue and nail them in. The top drawer will be stopped by the back of the cabinet.

Finishing

As I mentioned earlier, it's much easier finishing the interior parts of the chest before assembly. I applied a dark stain and two coats of thin–cut shellac to the inside of the carcase, the rails and dust panels, and the underside of the top. You should also stain and seal the drawers, except for the fronts.

I painted the exterior to produce a more formal finish than could be achieved with stain over pine. First mask off the interior portions of the carcase and drawers. Then apply two coats of thin–cut shellac to seal the wood—it's the only way I've found to keep the knots from bleeding through. Dilute an oil base primer with mineral spirits to help the paint flow and reduce brush marks, and apply one or two coats as needed. Sand lightly between coats. Then apply two to three coats of paint also thinned with mineral spirits. After the paint has thoroughly dried, apply two to three coats of polyurethane. Attach the hardware and you're ready to set the chest in place, fill the drawers, and accept all compliments. PW

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Date: February 16
Event: Tool Clinic with Simon Watts
Location: San Francisco
For information, contact: National Maritime Museum, Bldg. 275, Crissy Field, SF, CA 94109. Tel. (415) 929-0202

Date: February 23-24, March 2-3 & 9-10
Event: Building the Chamberlain Dory Skiff with Simon Watts
Location: Hyde Street Pier, San Francisco
For information, contact: National Maritime Museum, Bldg. 275, Crissy Field, SF, CA 94109. Tel. (415) 929-0202

Date: March 2-3
Event: East Bay Crafters Carving Show
Location: Lake Merritt Garden Center, Oakland
For information, contact: California Carvers Guild, Cavalier Plaza, 250 San Simeon Ave., San Simeon, CA 93452. Tel. (805) 927-4718

Date: March 16-17
Event: Ramona County Carvers Show
Location: Hemet
For information, contact: California Carvers Guild, Cavalier Plaza, 250 San Simeon Ave., San Simeon, CA 93452. Tel. (805) 927-4718

Date: March 22-24
Event: Woodworking Show
Location: Community Convention Center, Sacramento
For information, contact: Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. Tel. (213) 477-8521

Colorado

Date: March 15-17
Event: Woodworking Show
Location: National Western Complex, Denver
For information, contact: Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. Tel. (213) 477-8521

Connecticut

Date: March 23-24
Event: Carving the Ball Claw Foot (18th Century Methods)
Location: Brookfield
For information, contact: Brookfield Craft Center, Box 122, Rte. 25, Brookfield, CT 06804. Tel. (203) 775-4526

Florida

Date: March 8-10
Event: Woodworking Show
Location: State Fairgrounds, Tampa
For information, contact: Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. Tel. (213) 477-8521

Illinois

Date: February 8-10
Event: Woodworking Show
Location: Gateway Center, Collinsville
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Kansas

Date: February 15-17
Event: Woodworking Show
Location: Merchandise Mart, Overland Park
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Louisiana

Date: March 15-17
Event: Woodworking World Show
Location: Municipal Auditorium, New Orleans
For information, contact: Woodworking Association of North America, 1-800-521-7623

Montana

Date: March 22, 23 & 24
Event: Good Wood Show
Location: METRA Center, Billings
For information, contact: Monty Sullins, Montana Woodcarvers Assoc., 204 Nash Lane, Billings, MT 59105. Tel. (406) 245-8173

New York

Date: February 14-April 28
Event: Furniture by Wendell Castle
Location: American Craft Museum, New York City
For information, contact: Detroit Institute of Arts, 5200 Woodward Ave., Detroit, MI 48202. Tel. (313) 833-7963

North Carolina

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Event: Windsor Chairmaking Classes
Location: Marshall
For information, contact: Country Workshops, 90 Mill Creek Rd., Marshall, NC 28753. Tel. (704) 656-2280

Date: February-April
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For information, contact: Paxton Beautiful Woods Store, 5420 South 99th East Ave., Tulsa, OK 74147-0171. Tel. (918) 665-2411

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For information, contact: Wood Turning Center, Box 25706, Philadelphia, PA 19144. Tel. (215) 844-2188

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For information, contact: Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, TN 37738. Tel. (615) 436-5860

Date: March 18-22
Event: Hardwood Flooring Installation School
Location: Memphis
For information, contact: National Oak Flooring Manufacturers Association, Box 3009, Memphis, TN 38173-0009. Tel. 901-526-5016

Texas

Date: March 1-3
Event: Woodworking World Show
Location: Pasadena Convention Center, Pasadena
For information, contact: Woodworking Association of North America, 1-800-521-7623

Date: March 22-24
Event: Woodworking World Show
Location: Villita Assembly Building, San Antonio
For information, contact: Woodworking Association of North America, 1-800-521-7623

Date: April 4-7
Event: Fifth National Symposium
Location: Dallas
For information, contact: American Association of Woodturners, 667 Harriet Ave., Shoreview, MN 55126. Tel. 612-484-9094

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Date: February 15-17
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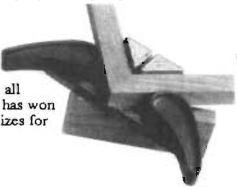

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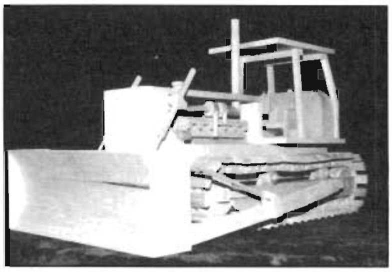

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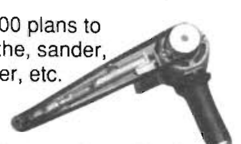

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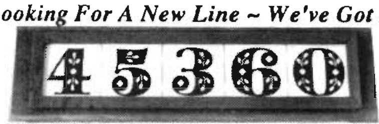

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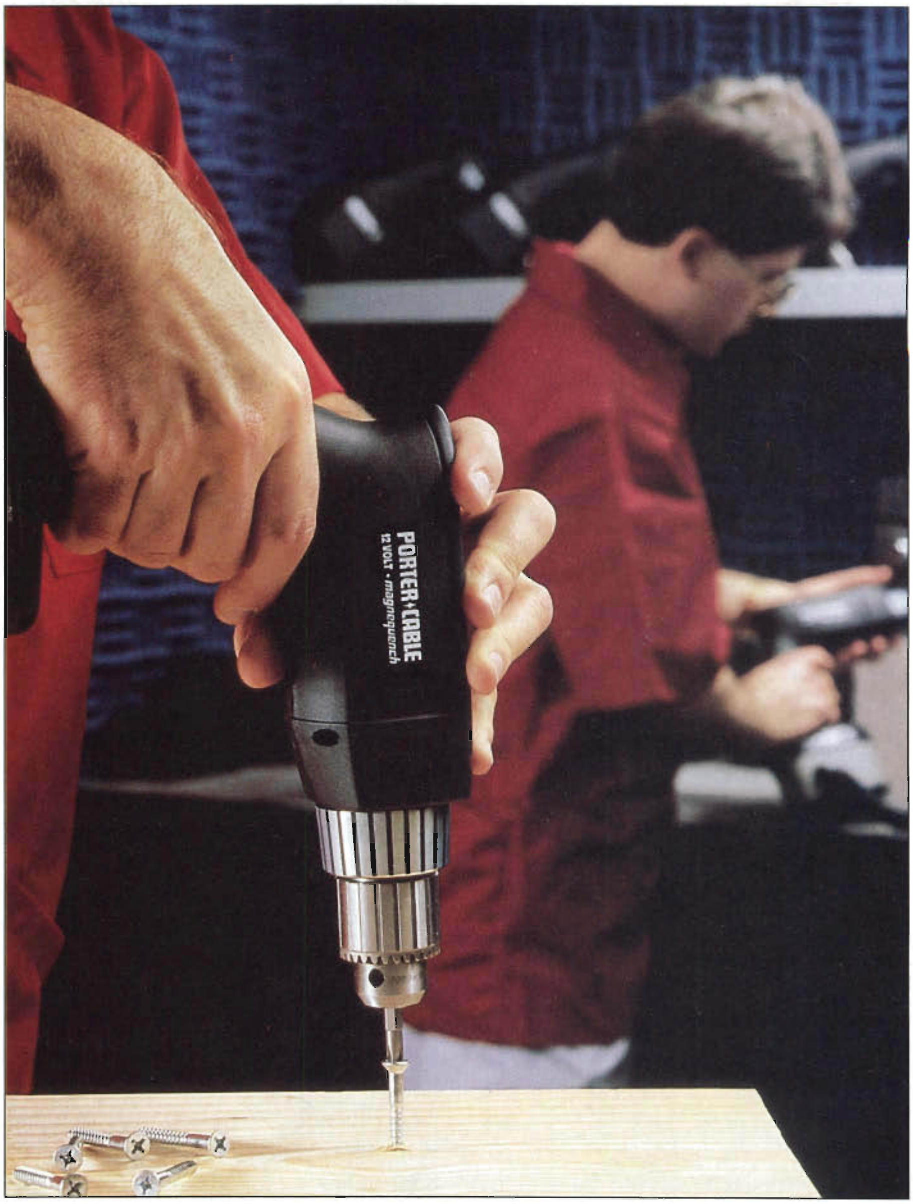


The Latest in 12–Volt Cordless Drill Technology

Suddenly it seems as if everyone's making a 12–volt cordless drill. I've been sent so many manufacturer's press releases over the last year that promoted their version of the "ultimate" in power and torque that I finally broke. Making the assumption that not everyone's drill could be number one, my testers and I took to finding out which of these tools were better and why. Before discussing our findings, however, I want to give you some background on cordless technology.

Batteries

Obviously, the thing that gives a cordless drill its power is a battery. Actually, it's more than just one battery; it's a sequence of the little guys. The nickel–cadmium battery cells typically found in cordless drills come in 1.2–volt increments. A 12–volt drill actually makes use of ten 1.2–volt batteries that are wired together in a neat little package.

Now, there are different battery sizes, and there can be a difference in battery quality as well. All of the 1.2–volt batteries put out 1.2–volts worth of power, but some 1.2–volt cells can retain and put out more energy for longer periods because they are larger. But size adds weight, and yes, you guessed it, the bigger cells also cost the manufacturer (and then you) more dough.

We didn't cut up the battery from each drill that we tested (messy, and a little dangerous), but the testers did charge, use, discharge, recharge, and reuse all of the units surveyed many times over. Our findings are not scientific, but we can give you an idea of how the tools performed under constant use.

I've been using cordless units since they were first in prototype stages some years back, and I always recommend getting a second battery. No battery lasts forever without recharging, and getting stuck with a dead tool in the middle of a project is no fun. With a second battery, one can charge while the other is working for you. Even the units with the fastest charge time come with two batteries.

__Sanford Wilk__ is a builder and organic architect in Boston, Massachusetts. His team of technicians—in fields ranging from finished carpentry to cabinetry and furnituremaking—evaluate tools under actual working conditions.

Quick Turnaround

Speaking of charge time, a little background here would be helpful. There are three methods of recharging a nickel–cadmium battery. The first method "dumps" a large dose of juice into the battery pack, the second method "pulses" the battery with power, and the third option is closer to the old "trickle" charge method.

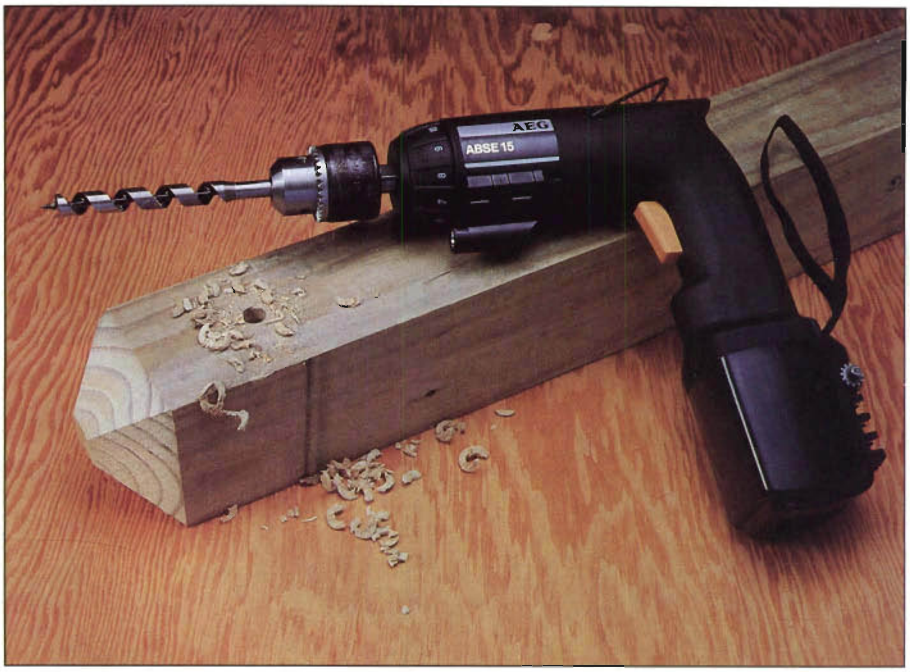
Here's how they work: the dumping method sort of socks it to the battery pack. This is how some of the really quick chargers do their stuff. In theory it's great, but in practice, if the battery temperature isn't closely monitored, it can overheat and vent. Thanks to Underwriters' Laboratories, batteries are unlikely to blow up because of a hot charge. They have built–in check valves that open when the battery gets too close to overheating. Of course, the battery pack becomes useless after venting, so the makers of the fast–chargers use electronics to monitor the battery temperature. Even with close scrutiny, however, battery life (over the course of months) can be significantly reduced by using the "dump" method.

In the pulse method of charging, the charger zaps, then waits, zaps again and so forth, until the pack is charged. The zap/wait sequence occurs many times over the course of a second (actually, it's milliseconds for you clock watchers). The brief waiting time before another zap allows the battery pack to take a rest and cool a little. The pulse method of charging will greatly increase a battery's lifetime, but unfortunately, the one company that I know currently developing it (Metabo of Germany) hasn't brought it to the United States yet. I hear stories about a 7–minute charging time and long battery life, but as of this writing, they are just stories.

The third method is actually a cross between the "dump" and the "trickle" method. It's slow in charging (usually an hour, sometimes longer) but since battery temperature can be monitored more closely, a battery can last 50% longer than those using the "dump" method. Finally, the slow "trickle/dump" fills a battery closer to capacity, and that means more production time in between charges.

The Question of Torque

You might notice that one manufacturer insists that drill "X" will drive one hundred #8 X 1$^1/_4$" screws, while a second



tool maker says that their unit will drill forty-five $^7/_8$" holes into $^4/_4$ red oak. A third company comes on the scene telling you that their new "super–duper" drill will set forty $^1/_4$" X 2" long lag screws with no problem because the unit has the "highest torque rating in its class." "Wow!" you say, "what does this mean, and how can I compare them?"

It's actually rather simple. Check out the unit's speed range and torque rating. As a rule of thumb, most drills that run at lower speeds have more torque and vice–versa. Choose higher torque if you plan to be driving more fasteners than drilling holes. Choose lower torque/higher speed if drilling clean holes is a priority. Some units have a dual range of speeds (i.e.: 0-400, and 0-900 rpm's) and can offer you the option of a little of both worlds. We'll let you know which ones seemed to have good torque from the field test point of view. We won't get into gear–reduction ratios, etcetera. Instead, the testers' comments deal more with how it felt to actually use the tool.

Testing

AEG Model ABSE 15

I list this one first because it's first alphabetically, but our testing revealed this unit to be number one in performance as well.

In the battery endurance race this drill placed between "good" and "excellent." We abused the battery in commercial conditions that you might never use it in, and it still did its duty. Our standard "torque abuse test" was to run 3" galvanized decking screws into a KD fir 4 X 4; the AEG unit just smiled and whirred as those huge fasteners sank into the dry wood without pre–drilling.

The charge time on the unit is one hour, but as I discussed above, that can be beneficial, too. In the category of balance and feel, you need only pick up this tool to realize that its German engineers were

12–Volt Cordless Drills

Unit Tested	Speed Range	Maximum Torque*	Charge Time	Weight	Chuck	List Price	Rating 1-10
AEG ABSE15	0-380 0-1100	160 in/lbs	1 hr	3.5 lb	1/2"	$399	10
Black & Decker 1965R	0-400 0-1300	175 in/lbs	1 hr	3.75 lb	3/8"	$281	9
Milwaukee 0398	0-350 0-1000	156 in/lbs	30 min	3.7 lb	3/8"	$275	9
Panasonic EY6205	50-350 150-1000	156 in/lbs	15 min	4.1 lb	3/8"[1]	$410	8
Porter–Cable 9850	0-400	165 in/lbs	1 hr	4 lb	3/8"[2]	$240	7
Ryobi TFD–220VR	0-400 0-1300	220 in/lbs	1 hr[3]	4.2 lb	3/8"[1]	$303	9
Skil 2735	0-500 0-1650	85 in/lbs	1 hr	4 lb	3/8"	$231	4

*according to the manufacturer [1]keyless [2]keyless optional [3]optional 15–minute charger

serious about ergonomics when they designed the thing. It's beefy, solid, fits a grown man's hand well, and is well machined. The drill definitely gets a "10" in the category of human engineering. It also has a 1/2" chuck where the rest of the test units have a 3/8" capacity (except for a single–speed Panasonic unit that was not tested in this comparison). This drill even has a built–in light for seeing into tight places, as well as an electric brake.

Yet another nifty feature is located not in the drill, but in the charger. The AEG's charger can actually operate at temperature extremes that can't be handled by any of the others. AEG accomplishes this with a multi–method charger that makes use of all three charging methods discussed above. If the room and battery temperature are too low for a quick charge, then the charger will trickle charge until the battery is warm enough to fast charge. No time is wasted.

With excellent speed ranges, a nice case, two batteries included, and a 10–position clutch (versus the average 5–position standard), the AEG unit gets our best score, and is definitely the standard by which we judged other units. It is expensive, but worth it, if state–of–the–art is what you're looking for. (AEG Power Tool Corp., 3 Shaw's Cove, New London, CT 06320; 800-243-0870)

Black & Decker Model 1965R

The folks at Black & Decker call this drill the Super Cyclone™. While we didn't take as much of a liking to this unit as we did the AEG, it is still a darn good tool. The battery lasts as long or longer between charges as any of the other units, thanks to rare earth magnets. Found also in the Porter–Cable unit, these magnets seem to increase tool efficiency, and help the power source last longer.

The Black & Decker's torque capacity was also among the best (see the chart above), and it passed our abuse test with no problem. Once again, the charge time for this tool is about an hour (depending on variables like room temperature and line voltage). And while the tool only comes with one battery, most stores will also have additional batteries available for purchase. We liked the balance and feel of the tool, though ergonomic design didn't seem to be as crucial for the Black & Decker engineers as it was for the AEG designers.

This drill has a couple of special features the others don't have. The first is a patented Versa–Clutch™ system that allows the operator to extend the torque power beyond the actual clutch setting. This is helpful if you hit a knot and need a little extra oomph. To activate the Versa–Clutch™, you just push harder on the drill and it kicks in, giving the drill a 25% power override. So if your clutch setting is 4, the chuck would normally stop turning at 19 inch/pounds, but with the Versa–Clutch™ activated you would power–up to 23.75 inch/pounds. Now, that may seem like a grand idea, but the three testers that used the drill constantly overrode the clutch because they kept consistent, heavy pressure on the unit. They did this because experience had taught them to do so—in order to keep a screwdriver bit seated in the fastener. In the end, they wished the tool didn't have this feature.

A feature that they did like immensely was a switch that transferred between drilling mode (non–clutched) and driving mode (clutched). This feature is found in other manufacturers' units, but only by turning the clutch all the way until it locks in the drill position. That's a hassle, and it wears on the tool and on your wrists. Black & Decker has developed a new standard here, and we can foresee many manufacturers following their lead.

All in all, the testers gave this fine drill a 9 rating. The price is okay, the features are nice, and this drill would be appropriate for any woodshop. (Black & Decker, 10 North Park Dr., Hunt Valley, MD; 800-638-0683)

Milwaukee Model 0398

Nothing special here except that Milwaukee has finally come out with a 12–volt unit. It's sturdy—definitely among the toughest tested—and thanks to price and dependability, will likely become the tradesman's choice. It offers a unique 30–minute charge time—perfect for lunch breaks.

This tool has no special feature or gimmick, but it does give the user a sense of power (it definitely passed the abuse test), reliability, and the manufacturer's history of longevity and professional acceptance. If you're looking for just the basics, but want a good solid tool, then look here. (Milwaukee Electric Tool Corp., 13135 W. Lisbon Rd., Brookfield, WI 53005; 414-781-3600)

Panasonic Model EY6205

This is the only mid–handle drill that we tested. The mid–handle design can foster more drilling control and comfort than the pistol–grip variety. That of course is a personal choice, and some folks feel the opposite is true. Still, it's nice to have this as an option when considering a purchase.

At Arm's Length

A new 8$^{1}/_{4}$" portable radial arm by Sears is designed to fit on bench tops. Its 2$^{1}/_{2}$ hp motor can develop a full 5,100 rpm, and the manufacturer claims clean cutting through 2$^{3}/_{4}$" hardwood stock at 90°. The yoke, carriage, and arm support are made of die cast aluminum for strength and rigidity, and roll–formed steel track allows for accurate arm movement (Sears stores throughout the United States)

A Sure Clamp

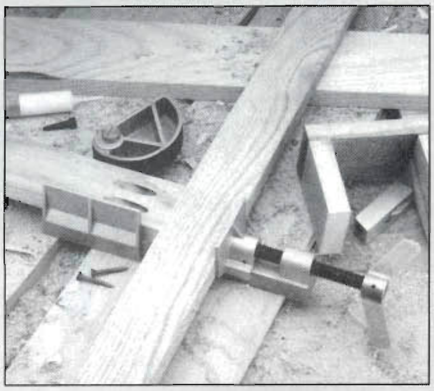
Leichtung Workshops has a new clamp offering that utilizes a cam to hold stock tightly in place. A quick rap opens the cam when the work is done, and the clamp is versatile enough to

The Panasonic unit comes with two batteries, and its 15–minute charge time made us wonder whether the power packs would discharge as quickly as they charged. Our suspicions were unfounded; the battery packs held their own. With a keyless chuck (also found on the Ryobi and Porter–Cable), and an electric brake, the unit offers some nice amenities. The charger is probably the most advanced of all the units. The Japanese engineers that created it gave it the power to tell the user exactly what level of charge the battery is at, by way of blinking LED's. We thought the charger was the nicest feature about this tool.

A good speed range, nice case, spare battery, and high–tech charger make this unit a real grown boy's toy—but sit down before you look at the price. (Panasonic Power Tools, 1 Panasonic Way, 4A-3, Secaucus, NJ 07094; (201) 348-5334)

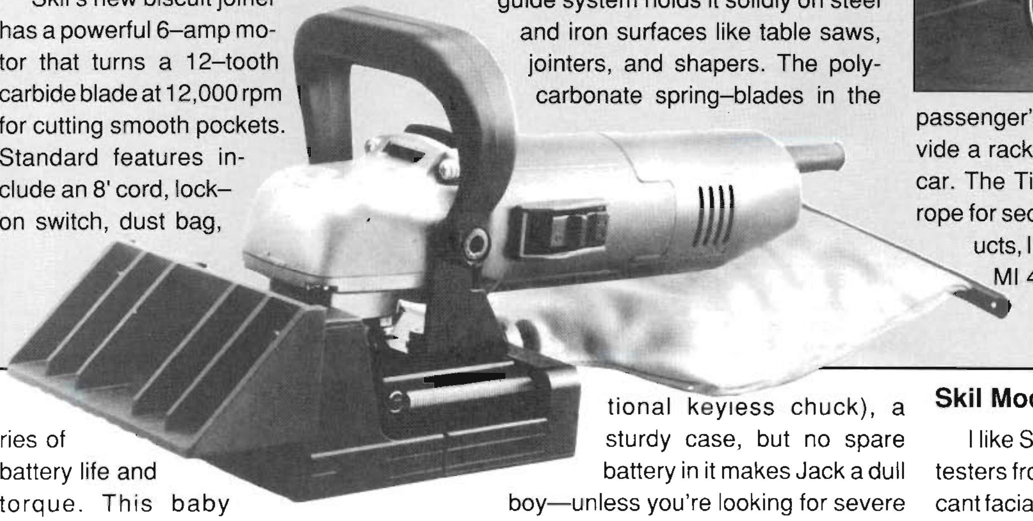
Porter–Cable Model 9850

They call this one the Magnaquench™, and it out–guns other units in the catego-



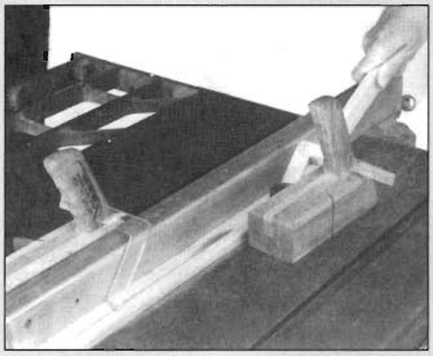
hold two pieces of stock at perfect right angles on their left or right edges, and even works upside down. (Leichtung Workshops, 4944 Commerce Pkwy., Cleveland, OH 44128; 216-464-6764)

Biscuits and Gravy



Skil's new biscuit joiner has a powerful 6–amp motor that turns a 12–tooth carbide blade at 12,000 rpm for cutting smooth pockets. Standard features include an 8' cord, lock–on switch, dust bag, and wrench storage on the tool itself. The joiner even comes with a case and biscuits so that you can get started right away. (Skil Corp., 4300 West Peterson Ave., Chicago, IL 60646; 312–286-7330)

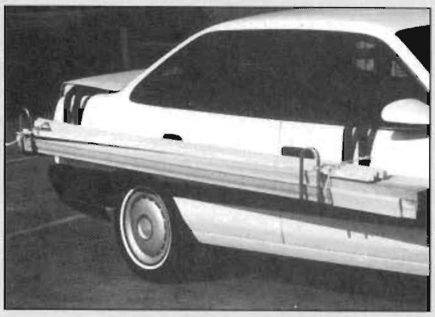
Magnetic Personality



Power magnets in the Grip–Tite™ guide system holds it solidly on steel and iron surfaces like table saws, jointers, and shapers. The polycarbonate spring–blades in the solid oak tool make sure that your stock won't wander off course. Like a featherboard, it takes the place of human fingers holding material against reference surfaces. (Mesa Vista Design, 804 Tulip Rd., Rio Rancho, NM 87124; 505-892-0293)

A New Type of Car Carrier

The Timber Tote™ eliminates the hassle of having to drive your car around town with lumber sticking out of the windows. A pair of totes attaches to the passenger's side door and trunk to provide a rack running the full length of the car. The Timber Tote comes with poly–rope for secure tie–downs. (Jupiter Products, Inc., P.O. Box 4367, Centerline, MI 48015; 313-228-9050)



ries of battery life and torque. This baby sailed through our torque abuse test. We even stepped up the amount of difficulty by using larger fasteners, and it still drove them home with little or no effort. However, where the tool suffers is due to this one–sided torque capability. It has a maximum speed of only 400 rpm, and that isn't too good for drilling.

I personally took a dislike to the chuck key holder which is not only located at the bottom of the battery pack, but is actually part of the retaining clip. Pull the key out without grasping the clip with your other hand, and the battery might drop to the floor, or worse, your toes (as it did to me—ouch!!). My best suggestion here is to do what the testers did: put the chuck key in your pocket.

No special features (besides an optional keyless chuck), a sturdy case, but no spare battery in it makes Jack a dull boy—unless you're looking for severe torque power for driving screws; then look here. (Porter–Cable, P.O. Box 2468, Jackson, TN 38302; 800-321-9443)

Ryobi Model TFD-220VR

This tool rated a "9" thanks to its good power level, nice speed range, and ergonomic design. It offers an optional 15–minute charger, but comes standard with a 1–hour unit. Also found on the Ryobi cordless drill is a well made keyless chuck that made bit changeover go faster, and nice machining that is the mark of quality. It passed all abuse tests, and though it lacks some other manufacturer's versions of features, it still is a valid choice for the woodworker. (Ryobi America Corporation, 1424 Pearman Dairy Rd., Anderson, SC 29625; 800-323-4615)

Skil Model 2735

I like Skil. They try hard, but this time all testers frowned. Probably the most significant facial expression came from me when a tester showed me that he could stop the drill's spinning chuck with just a single grab. He could perform this trick on no other unit that we tested, and couldn't even duplicate it on some of the 9.6–volt units that were in the shop.

At first, I thought it might be due to a drained battery, but an hour's worth of charging proved that theory incorrect. This unit just plain suffers from lack of torque. We couldn't make it pass our abuse test. As I mentioned before, we can't scientifically get a torque rating from these units, but the tester's grip–stop was sufficient proof for me. Sorry, Skil, but we cannot endorse this one. (Skil Corporation, 4300 West Peterson Ave., Chicago, IL 60646; 312-286-7330) PW

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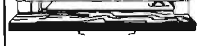

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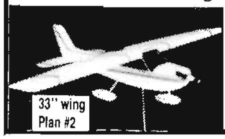

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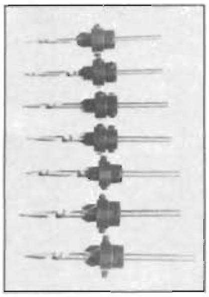

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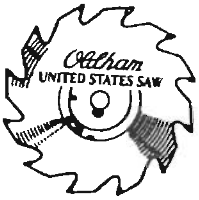

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White Oak

by Ken Textor

If I had to name my favorite North American hardwoods, white oak would be at the top of my list. For its near–perfect blend of strength, versatility, rot–resistance and availability, it has no equal. There are other species that individually are stronger, or more versatile, or more rot–resistant, or more readily available at a reasonable price—but only white oak has it all.

White oak belongs to a group which includes numerous distinctive species, but when ordering oak, it is only necessary to distinguish white from red. Red oak, discussed in the last issue of *Popular Woodworking*, has its virtues, but it doesn't compare with white oak. The common name *white oak* applies to over a dozen botanically distinct species, including white, bur, post, swamp, chestnut, swamp chestnut, swamp white, chinkapin, overcup, Oregon white and live oak. Each is a distinct species, but they are rarely separated from each other at the lumber yard. Sometimes live oak is separated out for reasons I'll discuss later.

White oak lumber is usually light brown to gray brown in the heartwood; the sapwood is creamy white. Live oak has a faint pinkish cast amid the light brown. Like the red oaks, they all have the distinctive "broad rays" cellular pattern readily evident in sawn lumber. Unlike red oak, the pores of white oak are closed, plugged with a membranous growth known as tyloses which makes the wood impervious to liquids. Oak is thus excellent for tight cooperage (buckets, barrels) and anywhere resistance to rot is desirable (outdoor furniture, boats). Some species of white oak are more resistant than others, but all of them are superior to most other domestic hardwood species.

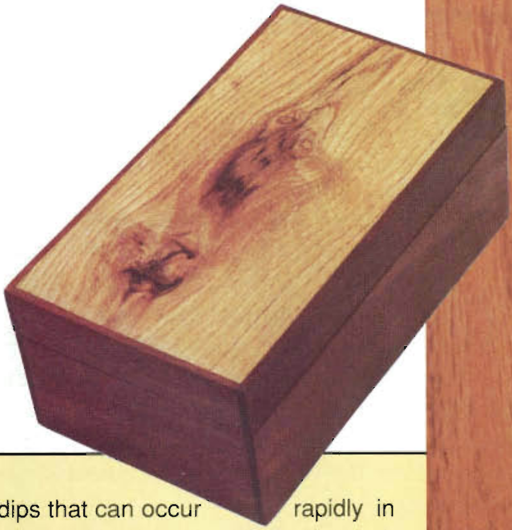
The weight and strength of white oaks are comparable to red oaks, and rank right up there with maples, ashes, elms and birches. Live oak, however, is in a class by itself. Its strength makes it one of the toughest of domestic woods, comparable to black locust, hop–hornbeam and a few other species that are usually fairly scarce around lumber yards. Live oak is readily available in the South, however, and in specialty lumber yards elsewhere. Most white oaks prefer growing in warmer climates, and become quite scarce as you approach the Canadian border. They flourish in their greatest numbers in the central Appalachians down to the Gulf Coast. Several species are also found on the West Coast.

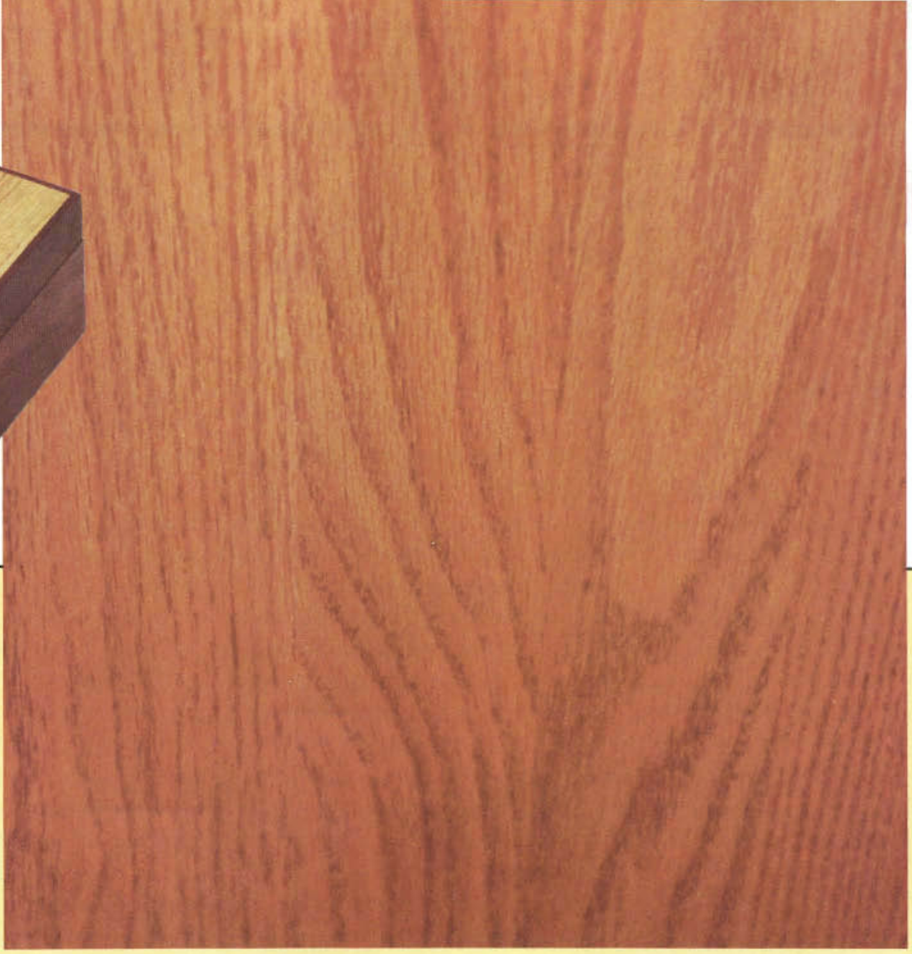
White oak has been used in just about everything from boats, furniture, flooring and cabinetry to railroad ties, cabooses and caskets. It does tend to shrink a lot, and should be purchased very dry. Unless you intend to bend it, get it kiln–dried with a moisture content of 10% or less.

Working Properties

When working with dry white oak, make sure you have tools that are razor–sharp and will hold their edge. It tends to dull second–rate tools very quickly, much more so than any other domestic hardwood I've worked with. Despite its toughness, it's generally easy to work. It's usually very straight–grained and not very prone to chipping as it passes through the planer or joiner. Its toughness helps prevent sand-

Ken Textor *is a woodworker and writer in Arrowsic, Maine.*





ing dips that can occur rapidly in boards of softer woods. Like red oak, it contains an acid once used for tanning hides into leather. Many people are allergic to it, especially when working slightly green white oak; gloves, long sleeves and good ventilation will help limit this reaction.

Why would you want to use green white oak? For its bendability, of course. Boatbuilders and furniture makers appreciate white oak in particular for its ease of bending when steamed. But you must start with green lumber or the bending is tough to impossible. White oak is superior to red oak because it's much more resistant to splitting during the bending process due to its closed–cell structure. Lumber with a moisture content of 40% or more is best for bending.

Fastenings of all sorts work well with white oak, but you'll have to drill the correct size hole for both screws and nails. A hole too small will end in a bent nail or the screw head twisted right off. As with red oak, there are chemicals in the wood that bond with iron. This means that after about a year or so, fasteners with iron in them can't be removed without damaging the surrounding wood.

Epoxy glue is the only common wood adhesive that doesn't work well with white oak. Because of its closed–cell structure, epoxies have nothing to grab onto and seal the bond of a tight joint. The joint then becomes "glue–starved" and eventually breaks. Some epoxy manufacturers recommend overcoming this by cutting very fine "glue hollows" into the surface of the joint where, once the pieces are put together, the hollows won't show. But epoxies vary from company to company, and it's best to contact the manufacturer before proceeding.

Finishing

White oak finishes a bit more easily than red oak, although it lacks some versatility here. Because of the closed pores, the surface should take fewer coats of varnish than red oak to become perfectly smooth. But those same closed pores prevent some interesting effects you might otherwise be able to produce with paste fillers and stains. I've noticed, too, that over the years white oak finished in clear varnish or shellac seems to shed its coating fairly easily when stressed or impacted even slightly. This is usually true after the finish has been on for ten years or so. Paint dealers have been at a loss to explain this to me, but another coat of finish every eight years or so seems to be the solution.

Availability

The central Midwest, the Appalachians, and the South have the greatest supply and variety of white oak lumber, but it's usually available through any lumber supplier in the continental United States. Plywood, veneer and quarter or plain sawn whole lumber are generally available, too.

As with red oak, always order the top grade. I've found the knots, twisted grain, tension splits and sap pockets found in the "pallet stock" grade not worth the time and trouble. The price range is generally the same as red oak, from $1.50 to $3.00 per board foot, depending on location. Live oak is usually about 10% to 20% higher. Also, market fluctuations will push the price up to $4.00 or more. This is unpredictable, but often follows hard on the heels of a media blitz advocating the use of white oak for some home improvement or another. So when it's cheap, keep a good stock on hand.

One last note on white oak availability: don't be impressed by someone who wants to sell you lumber cut from old growth stock at a premium price. Many forestry experts tell me that unlike pine and some other softwoods, oak from virgin forests is no tougher or more durable than lumber milled from second growth trees. True, virgin growth is tough—in most cases impossible—to find, but you should be able to find good, strong, durable lumber from oaks a mere hundred years or so old. PW

Out of the Woodwork

by Paul Gerhards

Back in the Sawdust Again

I was a terrible student. I graduated in the bottom third of the bottom third of my high school class of 1969. It would have been much worse if I hadn't finally figured out in my senior year that school did have some use.

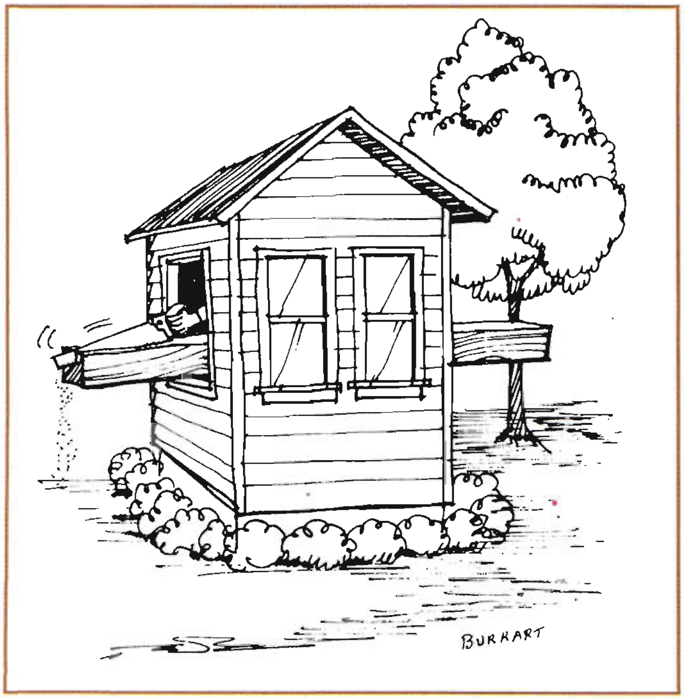
I took shop in ninth grade, but the only project I can remember finishing was an odd–looking tray with bits of blue ceramic tile in the middle. My not–so–fondest memory is of the time when my shop teacher told me—and the rest of the class—that I was "an example of a complete idiot." I was no better in English. On a test in American Literature I wrote, "Since I don't know Upton Sinclair personally, I have no idea what was on his mind when he wrote *The Jungle*." The teacher was not impressed with my honesty.

Math was my worst subject. As a freshman I struggled through a course called General Math. Because I failed Algebra in tenth grade I had to repeat it in eleventh. I was the only senior in Geometry. Fortunately, I was able to grasp what geometry is all about and passed. Still, I remember thinking way back then, "What good is all this? I'm never going to use it."

And then one day years later I was laying out a stair jack for a house I'd built, trying in vain to divide fractions. I recalled that foolish attitude I once fostered. If only I'd known then that the class cut–up would one day be cutting up boards for a living!

I've cut lots of boards over the years. I've done just about everything that can be done as far as building or remodeling a house is concerned, from concrete to cabinets, framing to finish work, shingles to sheetrock. I had a nice shop. It was inconceivable not to have a shop—as much a necessity for me as for anyone who prides himself on being an accomplished do–it–yourselfer.

***Paul Gerhards** is a woodworker and freelance writer in Portland, Oregon.*



Eventually, though, my life began to take a slow turn. I traded my nail apron for a typewriter and started writing. Newspaper work started to take up a lot of my time. And then there are those three unpublished novels. But I had the best success in writing about what I knew most: cutting boards and sticking them together. I wrote about things I made and about others who enjoy life in dusty woodshops.

Then I lost my home and my shop. I stuck my tools in the loft of my father's barn, where they gathered just about every kind of dust imaginable—except sawdust. Woodworking had lost its charm. I shuddered at the thought of working with my hands on anything more damaging than a computer keyboard. I never really expected to use my tools again, but then, I never really expected things to turn out quite the way they have.

I married a woman who knew me only as a writer, not as a woodworker. Of course, I told her about my history and my forsaken abilities. We even talked about "projects" I could do around the house that went beyond putting up shelves or fixing a door that didn't latch. But at the time, my heart just wasn't in it.

Then came another of those slow but inexorable turns. When my wife said we needed a picnic table, I said, "I'll make one." My mind began to churn with variations on the theme. I gathered up some of my hand tools, bought a bunch of boards, and laid them out on the deck behind the house. I started cutting. And I began to wish for a shop.

Later, when we started looking for a larger house, I had two requirements: a place to assemble words, and a place to assemble pieces of wood. I got both. I resurrected the rest of my tools from the hayloft, dusted them off, and set to work at something I hadn't done for years. As sawdust piled up around me, settled in my hair and permeated my clothing, I began to take a renewed satisfaction in the process of cutting up boards and sticking them together.

In that long–ago shop class, the teacher took a board and squared a line across the grain. He handed me the board and a crosscut saw. The saw chattered and buckled in the kerf. I couldn't cut along that line to save my life. It's almost funny, now that I think about it. It's funny, too, in a wry sort of way, to think that I once considered literature frivolous and math useless.

As I recall my high school years, I am amazed at the irony of how things have turned out. Indeed, things never just "turn out." It's a process of turning out. One thing always leads to another, regardless of how incongruous the two seem at first. Even at the completion of a satisfying wood project, the work is never truly finished. If nothing else, the sawdust must be swept off the floor.

No matter what, there is sawdust, and sawdust is not such a bad thing. PW

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